T E C H N I C A L M E M O R A N D U M

MIDNITE MINE PHASE 1A
ROUND 1
HYDROGEOLOGIC EVALUATION

Prepared for
EPA Region 10

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Activities for the Midnite Mine Phase 1A field program were conducted during the period September 1 to October 29, 1999. Field activities included the installation and development of 49 monitoring wells and three piezometers; groundwater sampling of 47 new wells and 10 existing wells; sampling of surface water and stream sediments at 57 sites; and measurement of water levels and stream flows. All tasks were conducted in accordance with the Standard Operating Procedures (SOPs) contained in the Quality Assurance Project Plan (QAPP) for the Midnite Mine Phase 1A RI/FS (URS Greiner, August 1999).

This technical memorandum provides the field methods and deviations from the QAPP, construction details for the monitoring wells installed, a groundwater level data analysis, a potentiometric map derived from water levels measured during the Phase 1A Round 1 sampling event, a summary of the observed hydrogeologic conditions at the site, and a summary of the preliminary analytical data for samples collected during Round 1.

2.1 DRILLING AND SAMPLING OF BOREHOLES

Drilling was conducted using air rotary and auger methods by Cascade Drilling of Portland, Oregon during the period September 8 to October 11, 1999. Drilling was performed in accordance with SOP Number 1, Drilling and Sampling of Subsurface Materials with the following deviations: air rotary drilling methods were utilized for the project instead of reverse-circulation methods; drill cuttings were collected directly from the cyclone into a steel hopper and placed near the edge of the west side of the South Spoils mine waste pile near well GW-44 in a location where runoff is contained by the pile; and, samples were archived only from the screen interval depth of background bedrock borings instead of from both bedrock and alluvial background borings. Air-rotary borings were advanced by installing a 9 3/4-inch outside diameter (O.D.) steel surface casing to an appropriate depth to stabilize the borehole. The boring was continued below the surface casing using a 7 7/8-inch downhole hammer to the total depth of the boring. Potable water was injected as necessary to cool the drill bit and return drill cuttings to the surface. Drill cuttings were collected in a hopper and transported by forklift to the dump area near the West Side mine waste pile. Auger drilling was conducted using the CME-75 drill rig with 10-inch O.D. hollow-stem augers. Cuttings were contained in drums and transported to the dump area for disposal. All downhole equipment was decontaminated between borings in accordance with SOP Number 10, Decontamination.

Borings were logged in accordance with SOP Number 2, Borehole Logging. Lithologic and hydrologic information was recorded on Boring Log Forms and in the field notebook by the rig geologist. Geophysical logging (fluid temperature, caliper, single-point resistivity, and natural gamma) was performed in all deep bedrock boreholes (boreholes advanced below the depth to first water) using a portable Mt. Sopris MGX logger as described in SOP Number 13, Borehole Geophysical Logging. The downhole logging was performed to aid in the selection of the appropriate screen interval for the well. Fluid temperature, caliper, and natural gamma logs were run in all boreholes logged. Single-point resistivity was logged at the discretion of the rig geologist to provide additional information, where necessary. At the discretion of the rig geologist, geophysical logging was also performed in the borings targeted for completion near the water table which produced small amounts of water to confirm the source of water.

If necessary, boreholes were backfilled to the appropriate depth to set the well screen prior to well installation. Boreholes were backfilled using clean 10-20 silica sand. A five-foot thick seal of bentonite chips or slurry was placed above the sand to seal the backfilled portion of the borehole from the well interval.

2.2 INSTALLATION OF MONITORING WELLS

Monitoring wells were installed in the open borehole through the surface casing for air-rotary boreholes and through the augers for auger boreholes in accordance with SOP Number 3, Monitoring Well Installation. Surface casings were removed by hydraulic jacking after installation of the well casing. Deviations from the SOP are discussed below. Two feet of fine sand and a bentonite slurry was used as the seal and backfill material for most borings. After settlement of the bentonite grout, the boring was topped off with cement-bentonite grout to within 3 feet of the ground surface. For shallow wells with the top of the screen placed above the static water level, the seal and backfill consisted of bentonite chips only. Bedrock borings

were completed with well screens with 0.03 inch openings. Well screens and risers consisted of 4" Schedule 80 PVC in most cases. A few wells less than 150 feet deep were installed using 4" Schedule 40 PVC. All filter packs consisted of 10-20 silica sand with two feet of 20-40 sand placed on top to act as the well seal. Surface completions consisted of a 5-foot long 8-inch diameter steel protective casing set 2.5 feet into the ground in concrete. The protective casings were surrounded by a circular concrete well pad two feet in diameter and 12 inches thick with approximately eight inches of concrete below ground and four inches above ground. Wells completed in high traffic areas were surrounded by three steel traffic posts set three feet into the ground in concrete. Traffic posts were also installed around other wells as needed to protect the well during sampling operations.

2.2.1 Monitoring Wells In the Potentially Impacted Area

This section discusses monitoring wells installed in the Potentially Impacted Area (PIA). Monitoring wells installed in the background areas are discussed in Section 2.2.2. Twenty-nine monitoring wells and three piezometers were installed in the PIA during the Phase 1A investigation as shown on Figure 1. Table 1 presents construction details for each well completed in the PIA. Boring logs and well construction diagrams for each well and piezometer installed in the PIA are provided in Appendix A.

One water table monitoring well (MWNW-07) was installed in the area of exposed mineralized rock on the Northwest Ridge. This well was one of seven wells originally proposed to be installed on the ridge. Wells MWNW-01, MWNW-02, MWNW-03, MWNW-04, and MWNW-06 were installed and water levels measured in them in association with the Round 1 groundwater sampling. Previously planned piezometer MWNW-05 was not installed because of equipment access problems. The water level measurements from the wells on the ridge indicated that the potentiometric surface beneath the ridge is several hundred feet higher than the water level in Pit 4. The Northwest Ridge is a groundwater divide and therefore these five wells are hydraulically upgradient of the Mined Area (MA) and provide water quality data representative of background conditions. Well MWNW-07 was retained within the PIA because of its location in the area of exposed mineralized rock above Pit 4. Water was encountered during the drilling of MWNW-07 at a depth of 137 feet. The well screen was set from 130-150 feet bgs across the water-producing interval.

Five monitoring wells (MWFW-01, MWFW-02, MWFW-03, MWFW-04, and MWFW-05) were installed in the Far West Drainage. Paired wells MWFW-01 and MWFW-02 were drilled to total depths of 31.0 and 130.8 feet bgs. Water was encountered during drilling of boring MWFW-01 at a depth of 19 feet bgs in alluvium. The well was constructed with the screen placed from 15.0-30.0 feet bgs in this well. Water was encountered during drilling of deep bedrock boring MWFW-02 at a depth of about 90 feet bgs and subsequently rose to 16.5 feet overnight. The source of this water was assumed to be the overlying alluvium and drilling was continued to the total depth of 130.8 feet bgs. Caliper logging of boring MWFW-02 was performed and indicated fracture zones at 109-111 and 126-128 feet bgs. The temperature log also showed an inflection of about 0.05 degrees at 108.5 feet bgs. Based on the information from the geophysical logging, the well was constructed with the screen interval set from 101.9-121.9 feet bgs across the upper fracture zone. Water table wells MWFW-03, MWFW-04, and MWFW-05 were completed in quartz monzonite bedrock at total depths ranging from 35 to 49 feet bgs. Water was encountered

during drilling at depths of 21 to 44 feet bgs and the well screens set near the bottom of the borings.

Two paired monitoring wells (MWSW-01 and MWSW-02) were installed in the Southwestern Drainage. Water table boring MWSW-01 was drilled to 27 feet bgs and the well screen set across the alluvium/bedrock contact. Water was encountered at 23 feet bgs during drilling of this boring. Deep bedrock boring MWSW-02 was drilled to a total depth of 165 feet bgs with minor indications of water. Geophysical logging was performed to identify potential water-producing fracture zones. The caliper log identified fracture zones at 112-118 and 125-130 feet bgs, and the temperature log showed a zone of apparent water inflow at about 110 feet bgs. Based on this information, the boring was backfilled to a depth of 125 feet bgs and the well constructed with the screen set at 102.0-122.0 feet bgs.

One monitoring well (MWWD-01) and two piezometers (MWWD-02 and MWWD-03) were installed in the Western Drainage. Previously planned wells MWWD-04 and MWWD-05 were not installed because of equipment access problems. Deep bedrock well MWWD-01 was installed as the paired well to existing shallow well MW-1 to a total depth of 119.6 feet bgs. Water was not encountered during drilling of this boring. Geophysical logging was performed and the caliper log indicated major fractures at 81 and 83 feet bgs and unfractured rock below this depth. The well was constructed with the screen placed across the two fractures identified. Piezometer MWWD-02 was initially drilled to a depth of 104 feet bgs in quartz monzonite bedrock at the end of the first work shift. Water was measured in the boring after four days at 35 feet bgs, but it was not known what interval was producing the water. Geophysical logging was performed and the temperature log identified a zone of water infiltration at about 60 feet bgs. The boring was backfilled to 71 feet bgs and the well constructed with the screen set at 50-70 feet bgs based on the geophysical logging results. Water was encountered during drilling of boring MWWD-03 at a depth of about 56 feet bgs. Boring MWWD-03 was completed as a piezometer in quartz monzonite bedrock with the well screen set at 35.5-55.5 feet bgs.

Two monitoring wells (MWCD-01 and MWCD-02) and one piezometer (MWCD-03) were installed in the Central Drainage. Wells MWCD-01 and MWCD-02 were installed as deep paired wells to existing wells MW-2 and GW-19 in quartz monzonite bedrock. During drilling of boring MWCD-01, water was encountered at a depth of about 108 feet bgs. Geophysical logging was performed to verify the source of water. The caliper and temperature logs for MWCD-01 showed a rubble zone at 100-115 feet bgs that also appeared to produce water. The well was constructed with the screen set across this interval from 95.0-115.0 feet bgs. Water was produced during drilling of boring MWCD-02 at rates of less than one to three gpm from 60 feet bgs to the total depth of 116.8 feet bgs. Geophysical logging was performed to identify the source of water. The caliper log showed a few small fractures between 78-80 and 91-92 feet bgs and a straight boring below these fractures. The well was constructed with the screen placed from 78-98 feet bgs and sand placed from the bottom of the boring to 7 feet above the screen. Boring MWCD-03 intersected a water-producing aplite dike at about 46-50 feet bgs. The boring was deepened to 64 feet bgs and the piezometer constructed with the screen placed across the dike from 40-60 feet bgs.

Ten monitoring wells (MWED-02, MWED-03, MWED-04, MWED-05, MWED-06, MWED-07, MWED-08, MWED-09, MWED-10, and MWED-11) were installed in the Eastern Drainage and tributaries to it. Previously planned well MWED-01 was not installed because existing well MW-6 could meet the objectives of the proposed well. The location of the deep paired well

MWED-02 was moved to be near the existing shallow well MW-6. Boring MWED-02 was initially drilled to a depth of 120 feet bgs with minor indications of water at about 60 feet bgs. Caliper logging showed a straight boring except for one fracture at 58 feet bgs. Based on the results of the geophysical logging and the indication of water at 60 feet, the boring was backfilled to 70 feet bgs and the well constructed with the screen placed from 48.0-68.0 feet bgs. Well MWED-03 was completed as the deep paired well to existing well MW-5. The boring was initially drilled to a depth of 110.6 feet bgs. Caliper logging of the borehole showed that the bedrock below the alluvium was fractured between 27 and 36 feet bgs with no significant fracturing noted below this depth. Water was also produced from this zone of fractures during drilling. Based on the results of the geophysical logging and the lack of fractured rock deeper in the borehole, the well was constructed with the screen set from 29.2-49.2 feet bgs across the zone of fracturing to monitor the shallow bedrock.

Well MWED-04 was installed as the deep paired well to existing well MW-4. An aplite dike was encountered at 102-108 feet bgs that produced water during drilling. The well screen was placed across this dike from 92.7-112.7 feet bgs. Paired wells MWED-05 and MWED-06 were installed along a former tributary to the Eastern Drainage that has been covered by mine waste and ore materials. Water was not encountered during drilling of MWED-05. This well was screened across the alluvium-bedrock interface at a depth of 9.6 to 24.6 feet bgs to monitor for water during the wet season. Deep bedrock well MWED-06 was initially drilled to a depth of 131 feet bgs. Water was produced from the boring at about one gpm below 110 feet, but the source of water was not identified. Caliper logging of this borehole was conducted and showed fractures at 34, 37, and 50 feet bgs and a straight borehole below this depth. Temperature logging did not reveal the source of water. Based on the results of the geophysical logging, the boring was backfilled to a depth of 56 feet bgs and the well was constructed with the screen placed across the three fractures from 31-51 feet bgs. Paired wells MWED-07 and MWED-08 were installed near the East Seep pumphouse. Water was encountered at about 35 feet during drilling of boring MWED-07. This boring was completed in quartzite bedrock and screened from 20.3-40.3 feet bgs. Water was encountered during drilling of boring MWED-08 at about 70 feet bgs. The water production increased from about one to about 4 gpm at the total depth of the boring of 139.6 feet bgs. Geophysical logging was performed to determine the source of the water. The caliper log showed a large fracture at about 72 feet bgs and no significant fracturing below 98 feet bgs to the bottom of the borehole. The temperature log did not reveal the source of water inflow. Based on the results of the logging, the boring was backfilled to a depth of 90.2 feet bgs and the well was constructed with the screen placed across the fracture identified from 68-88 feet bgs. Boring MWED-09 was initially drilled to a depth of 130.3 feet bgs. A small amount of water was produced from the borehole below 110 feet bgs. Geophysical logging was performed in the open borehole to determine the source of water inflow. The caliper log indicated fracturing at 99-103 feet bgs and the temperature log showed a slight shift at 102 feet bgs, indicating an influx of water from this zone. The boring was backfilled to 116 feet and the well was constructed with the screen placed across this water-bearing zone in calc-silicate bedrock.

Wells MWED-10 and MWED-11 were installed in the lower portion of the Eastern Drainage below the confluences with the Central and Western Drainages. Boring MWED-10 was drilled to 16.0 feet bgs in alluvium with water encountered at 1.5 feet. The well was constructed with 10 feet of screen placed from 5 to 15 feet bgs. Boring MWED-11 was drilled to a depth of 108.9 feet. Water was not encountered during drilling but accumulated in the borehole to 44 feet bgs

overnight. Geophysical logging was performed to determine the water-bearing interval. Caliper logging indicated two fractures at 73 and 104 feet bgs. The temperature log did not provide any information about the source of water to the borehole. Based on the caliper log and the observation that the boring was dry until drilled to the total depth, the well was constructed with the screen placed across the lower fracture identified on the log from 88-108 feet bgs.

Seven monitoring wells (MWNE-01, MWNE-02, MWNE-03, MWNE-04, MWNE-05, MWNE-06, and MWNE-07) were installed in the Northeastern Drainage. Wells MWNE-01 and MWNE-02 were installed as a shallow and deep well pair directly east of Pit 4 in weathered calc-silicate bedrock. Both borings produced substantial water during drilling. The wells were constructed with the screens placed near the bottom of the borings. Wells MWNE-03 and MWNE-04 were installed at the downgradient side of the former truck ready line area located to the southeast of Pit 4. Boring MWNE-03 was drilled through approximately 110 feet of fill before encountering native materials. Water was encountered during drilling at 115 feet, within the alluvium overlying the bedrock. The well was screened with 0.01-inch diameter slotted screen across the bedrock/alluvium interface at a depth of 116.5 to 136.5 feet bgs. During well installation, five feet of sand filter pack was placed around the well casing and then the fill material surrounding the boring collapsed onto the lower portion of the well screen. The top of the collapsed material was measured at 118 feet bgs. The well was completed with this material left in place. Therefore, the upper portion of the well screen is surrounded by native materials composed mainly of silt and sand instead of a sand filter pack. Well MWNE-04 was drilled to a depth of 247 feet and encountered an aplite dike that produced about 20 gpm at 230-233 feet bgs. Geophysical logging of the borehole confirmed the presence of a large fracture at 230 feet bgs and a temperature inflection just above this depth. The well was constructed with the screen placed across the dike from 217.5-237.5 feet bgs.

Wells MWNE-05 and MWNE-06 were completed as a well pair upgradient of the water treatment plant outfall pond. Boring MWNE-05 was drilled to a depth of 22 feet bgs with water encountered at 6 feet bgs. The well was completed across the alluvium/bedrock interface and screened from 5.0-20.0 feet bgs. Boring MWNE-06 was initially drilled to a depth of 121.7 feet bgs in calc-silicate bedrock and began producing water at about 70 feet bgs. Geophysical logging was performed in the open borehole. The caliper log and temperature log indicated a water-producing fracture at 78 feet bgs. Based on the logging and observations of water production during drilling, the boring was backfilled to 90 feet bgs and the well was constructed with the screen placed from 68-88 feet bgs. Boring MWNE-07 was drilled to the east of Pit 3 and encountered water at about 68 feet bgs in calc-silicate bedrock during drilling. The well was constructed with the screen placed from 63.3-83.3 feet bgs.

One water table well (MWND-01) was installed in the Northern Drainage. Water was encountered at about 65 feet bgs in phyllite schist bedrock during drilling of this boring. The well was constructed with the screen placed across several water-bearing fractures from 55-75 feet bgs.

2.2.2 Monitoring Wells in the Background Area

The background geochemical investigation was performed to collect samples representative of the natural concentrations of metals, radionuclides, and other inorganic parameters for surface water, groundwater, and sediments, as described in the QAPP. The purpose of the background

investigation is to evaluate the pre-mining conditions of the area. This information will be used to evaluate whether groundwater, surface water, and stream-deposited sediments in the PIA have been impacted by the materials or activities in the MA. Sample locations were selected based on a review of the previous investigations of the area and were revised during a reconnaissance to the field area conducted in July 1999. The approach of the background investigation is to measure natural concentrations of inorganic constituents at locations that: 1) are near the MA and PIA; 2) have similar hydrogeologic characteristics as the Midnite Mine; 3) have not been affected by mining; and 4) are accessible for drilling and sampling activities.

Twenty monitoring wells were installed as part of the Phase 1A background groundwater characterization program as shown on Figure 2. Ten of these wells were installed in bedrock and ten were completed in alluvium. Table 2 presents construction details for each background well completed. Boring logs and well construction diagrams for each background well are provided in Appendix B.

Five water table monitoring wells (MWNW-01, MWNW-02, MWNW-03, MWNW-04, MWNW-06) were installed in the bedrock on the Northwest Ridge. These wells are considered to be background wells because they are not downgradient from any portion of the MA. These wells were completed in quartz monzonite and phyllite schist bedrock at total depths ranging from 101 to 206 feet below ground surface (bgs). Water was encountered during drilling at depths ranging from 85 to 186 feet bgs in five of the borings and the well screens set near the bottom of the borings. Water was not encountered during drilling of boring MWNW-04. Geophysical logging (fluid temperature, caliper, and natural gamma) was performed in boring MWNW-04 to provide additional information to the geologist. The caliper and temperature logging indicated that a fracture zone at about 185 feet bgs produced water and the well screen was set across this interval.

Five additional background bedrock monitoring wells (MWBB-01, MWBB-02, MWBB-03, MWBB-04, and MWBB-05) were installed in areas beyond the Northwest Ridge. Boring MWBB-01 was drilled to a depth of 60 feet bgs in quartz monzonite bedrock on the north side of Spokane Mountain. Water was encountered at a depth of about 45 feet bgs during drilling of this boring. The boring was completed as a water table well screened from 39.5-59.5 feet bgs. Well MWBB-02 was installed to the north of Pit 4 on the Sand Creek drainage side of the Northwest Ridge. This boring was drilled to a depth of 40 feet bgs in quartz monzonite bedrock and water was encountered at 25 feet bgs. The well was constructed with the screen set from 19.5-39.5 feet bgs. Well MWBB-03 was installed on the northwest side of Spokane Mountain. The well was proposed as a deep well within the Spokane Mountain ore zone identified by Western Nuclear in the 1970s, however, quartz monzonite bedrock was encountered at a depth of only 50 feet bgs, with no water at this level, indicating that ore was not present at this location. The boring was drilled to a depth of 185 feet and water was first encountered at about 165-170 feet bgs. The well was constructed as a water table well with the screen placed from 162.0-182.0 feet bgs.

Deep well MWBB-04 was also proposed to target the unmined ore body beneath the north side of Spokane Mountain. Boring MWBB-04 was drilled to a depth of 300 feet bgs and geophysical logging performed to attempt to identify a water-bearing zone within the ore zone. Phyllite schist was encountered for the entire length of the boring. Caliper logging of the borehole showed prominent fractures at 200, 220, 250, and 290 feet bgs. Each of these zones produced water during drilling. The natural gamma log recorded 100-220 counts per minute (cpm) for much of the boring and increased to 350 cpm in the lower 10 feet of the boring. The rock from

this interval was also silicified and drilled harder than that above it. Based on the observations from the logging and drilling, it was concluded that the ore zone had been reached near the bottom of the boring and the well was constructed with the screen placed from 278-298 feet bgs.

Because well MWBB-03 failed to intersect the ore zone, well MWBB-05 was moved from its proposed location on a tributary to Sand Creek to the northeast face of Spokane Mountain near well MWBB-04 in an effort to place a second well within the ore zone as proposed. The target depth for boring MWBB-05 was initially set at 300 feet. However, water production during drilling increased greatly in the lower portion of the boring and reached 300 gpm at 250 feet bgs. Based on the magnitude of the water production, drilling was stopped at 256 feet bgs and geophysical logging performed. Caliper logging showed prominent fractures at 245 and 252 feet. These zones were accompanied by a change in temperature and the greatly increased water production noted during drilling. Gamma readings were 150-425 cpm. The natural gamma log indicated that the highest readings were higher in the boring at 170 to 200 feet bgs, however, water was not present at this depth. Based on the information from logging and drilling, the well was constructed with the screen placed across the water-producing fractures from 235.0-255.0 feet bgs.

Ten background alluvial wells (MWBA-01, MWBA-02, MWBA-03, MWBA-04, MWBA-05, MWBA-06, MWBA-07, MWBA-08, MWBA-09, and MWBA-10) were installed. Wells MWBA-01, MWBA-02, MWBA-03, MWBW-04, and MWBA-06 were installed to monitor shallow groundwater east of the mine. Wells MWBA-01 and MWBA-06 are screened in alluvium. Wells MWBA-02 and MWBA-04 are screened across the contact between the alluvium and underlying weathered quartz monzonite bedrock. Well MWBA-03 is screened entirely within the weathered quartz monzonite bedrock. Well MWBA-05 was installed on a tributary to Sand Creek and is screened across the contact between the alluvium and weathered quartz monzonite bedrock. Wells MWBA-07 and MWBA-09 were installed on tributaries to Sand Creek that drain Spokane Mountain and are screened in alluvium. Wells MWBA-08 and MWBA-10 were installed along the Sand Creek channel. Well MWBA-08 is screened in alluvium and well MWBA-10 is screened across the contact between the alluvium and underlying quartzite bedrock. Water was encountered during drilling of all background alluvial wells. Geophysical logging was not performed in these wells.

2.3 WELL DEVELOPMENT

Monitoring wells installed for this investigation were developed in accordance with SOP Number 4, Monitoring Well Development. The majority of the wells were developed using two Smeal water well trucks equipped with wire lines and bailers. Wells MWFW-03, MWFW-04, and MWFW-05 were developed using the Failing Star 30K drill rig by bailer. Wells MWBA-08, MWBA-09, and MWBA-10 were developed by hand bailing. Bailers were decontaminated between wells in accordance with SOP Number 10, Decontamination.

2.4 GROUNDWATER SAMPLING

Groundwater sampling was conducted in accordance with SOP Number 6, Groundwater Sampling. Field parameters were measured during purging and sampling in accordance with SOP Number 7, Field Parameter Measurements. Dedicated tubing was used for all monitoring wells sampled using a geopump or submersible pump. After use, the tubing was stored in a

labeled plastic bag for reuse in subsequent sampling events. Pumps were decontaminated between each well in accordance with SOP Number 10, Decontamination.

For the Phase 1A sampling event, 28 new and 10 existing wells were sampled in the PIA. Piezometers MWWD-02, MWWD-03, and MWCD-03 were not sampled. Well MWED-05 was dry. In addition, three seeps (WDSEEP, Dam Toe Seep, and East Seep) in the PIA were sampled under the groundwater sampling program. For the background area, 19 wells were sampled. Background well MWBA-09 contained insufficient water for sampling.

2.5 WATER LEVEL MEASUREMENT

Water levels were measured in all new and existing wells and piezometers in the MA and PIA during October 1999 in accordance with SOP Number 5, Monitoring Well Water Level Measurement. The measurements were used to determine the volume of water that needed to be purged from the well prior to sampling and for the construction of a potentiometric map of the site.

2.6 SURFACE WATER AND SEDIMENT SAMPLING

Surface water and sediment sample collection was performed during the period from September 8, 1999 to September 30, 1999. Surface water was collected in accordance with SOP Number 8, Surface Water Sampling, SOP Number 7, Field Parameter Measurements, and SOP Number 12, Surface Water Discharge in Streams and Seeps, with the following deviations: 1) The NPDES outfall site (OF01SW) consisted of an approximately 80 foot wide pond with outfall discharge provided by an 8-inch diameter acrylonitrile butadiene styrene (abs) pipe extending approximately 20 feet into the pond. The 8-inch abs pipe extended from the pond to the northeast to a locked pumphouse. Access could not be obtained to this pumphouse. To collect a representative sample of the outfall, the sample had to be collected from the discharge flow of the pipe within the pond by wading into the outfall pond while secured to shore by a polypropylene rope held by an attendant. The sampling technician tied a polypropylene rope onto a decontaminated 5-gallon bucket and tossed it into the discharge flow such that the bucket quickly sank within the discharge and was retrieved by the sampling technician for distribution into proper sample containers. The site safety officer was on-site and approved of this method of collection; 2) sites SWNW-03, SWBK-01, and SWBK-19 were slowly recharging seeps. At each site, a 3’ x 3’ x 1’ pit was excavated at the origination of the seep and was lined with plastic sheeting to allow for collection of sufficient water for sampling. This method was used rather than the stainless steel bowl method described in the SOP due to the large sample volume required; 3) samples were not placed in individual plastic bags as per the SOP, but rather were placed in coolers lined with a plastic garbage bag; 4) samples collected for radionuclide analyses were not placed on ice; 4) Chain of Custody forms were completed by the sample manager prior to sample shipment.

Sediment samples were collected in accordance with SOP Number 9, Sediment Sampling. No deviations from this SOP were performed in the field.

2.6.1 Surface Water and Sediment Sampling Sites in the PIA

Figure 3 provides the locations of the Phase 1A surface water and sediment sampling sites in the PIA. Twenty-seven surface water collection sites are located within the PIA. Surface water sampling and surface water discharge measurements were performed at 17 of the sites. The remaining 10 sites were dry. Sediments were sampled at all proposed sites regardless of whether water was present. Twenty-nine sediment collection sites were sampled in the PIA. The difference between the number of designated surface water and sediment collection sites is the result of sediment sites SDBC-02 and SDED-01 not being co-located with surface water collection sites.

A detailed description of each surface water and sediment collection site is provided in Table 3. A general description of the sampling sites by areas of interest within the PIA is provided below.

Surface water samples were collected and flow measurements conducted at all eight previously planned sampling sites within the Eastern Drainage. The Eastern Drainage is an intermittent drainage that primarily receives flow from the NPDES outfall site (OF01SW) located immediately north of the east haul road and extends approximately 6,400 feet south to its confluence with Blue Creek. Additional surface water contributions to this drainage are from the Central Drainage, Western Drainage, and various seeps located throughout the drainage. The stream occupies a channel approximately 2 to 8 feet wide with heavily vegetated banks. Sediments are present throughout the length of the channel and consist primarily of dark brown silt with sands and small cobbles. Sample locations are generally located along the access road located on the east side of the drainage in heavily vegetated areas with the exception of location SW-2/SDED-06 that is in a heavily wooded drainage with no vehicular access.

Surface water samples were collected and flow measurements conducted at two of the three previously planned sampling sites within the Central Drainage. Location SWCD-01 was dry during our site visit on September 11, 1999. The Central Drainage occupies a broad u-shape depression without a definable channel in the upper portion of the drainage just south of the toe of the South Spoils waste rock pile. Near the confluence with the Eastern Drainage (approximately 1,800 feet to the south), the Central Drainage occupies a channel approximately 3 feet wide with heavily vegetated banks approximately 2 feet high. Surface water contributions are primarily from seeps from the South Spoils waste rock and springs at each of the locations where surface water was collected. Sediments are present throughout the length of the channel and consist primarily of light brown silt with cobbles. Sample locations are generally located along established roads within heavily wooded vegetation.

Surface water samples were collected and flow measurements conducted at two of the three previously planned sampling sites within the Western Drainage. Location SWWD-01 was dry during our site visit on September 11, 1999. The Western Drainage currently originates just south of the toe of the South Spoils waste rock pile and flows to the confluence with the Eastern Drainage approximately 2,700 feet to the southeast. The Western Drainage occupies a broad channel in its upper reaches; however, near its confluence with the Eastern Drainage, the Western Drainage occupies a channel approximately 3 feet wide with heavily vegetated banks approximately 5 feet high. Surface water contributions are primarily from seeps from the South Spoils waste rock and springs at each of the locations where surface water was collected. Sediments are present throughout the length of the channel and consist primarily of light brown silt and cobbles. Sample locations are generally located along established roads within heavily

wooded vegetation with the exception of location WDAC/SDWD-03 which was accessed by driving along the ridge between the Western and Central Drainages and hiking approximately 250 feet into the wooded Western Drainage.

One previously planned sampling site (SWFW-01/SDFW-01) is located within the Far West Drainage and was dry during our site visit on September 09, 1999. This ephemeral drainage originates west of the South Spoils waste rock pile and occupies a u-shaped depression with a definable channel approximately 2 feet wide with 6-inch high vegetated banks. Sediment present at this sampling site consisted of light brown silty sand.

One sampling site (SWSW-01/SDSW-01) is located within the Southwestern Drainage and was dry during our site visit on September 11, 1999. This ephemeral drainage originates southwest of the southern portion of the MA and occupies a u-shaped depression with a definable channel approximately 2 feet wide with 6-inch high vegetated banks. Sediment present at this sampling site consisted of light brown silt with small cobbles and possible ash material.

The Northeast Drainage contains two previously planned sampling sites (SWNE-02/SDNE-02 and SWNE-01/SDNE-01), both of which were dry during our site visits on September 27, 1999 and September 11, 1999 respectively. The Northeast Drainage consists of all surface drainages that intersect the eastern MA boundary between the top of the Pit 4 headwall and the NPDES outfall (which serves as the boundary between the Northeast Drainage and the Eastern Drainage). Location SWNE-01/SDNE-01 is located below the eastern edge of the Pit 4 spoils. Sediment samples consisting of light brown silt with cobbles and pebbles was collected from two existing sediment retention basins at location SDNE-02. The Northeast Drainage below the sediment retention basins occupies a channel approximately 2 feet wide within heavily wooded vegetation.

One previously planned sampling site (SWND-01/SDND-01) is located within the Northern Drainage and was dry during our site visit on September 11, 1999. The Northern Drainage consists of the surface drainage from the MA and unmined ridge to the northeast of Pit 4. This ephemeral drainage originates at the northernmost portion of the PIA and occupies a definable channel approximately 2 feet wide with 6-inch high vegetated banks. Sediment was collected at this sampling site and consisted of light brown silt with cobbles and woody debris.

Nine PIA surface water/sediment collection sites are located along Blue Creek and its tributaries. Three Blue Creek tributary sites (SWBC-01/SDBC-01, TR04SW/TR04SD, and TR05SW/TR05SD) were dry during our site visit on September 28, 1999. Surface water was collected and flow measurements conducted at all locations except site TR06SW which had no measurable flow. Blue Creek originates at Turtle Lake and receives surface water drainage from the Eastern Drainage and other tributaries. Blue Creek flows into the Spokane River Arm of Roosevelt Lake approximately 3 miles below its confluence with the Eastern Drainage. Blue Creek occupies a definable drainage from 3 to 30 feet wide with vegetated banks 3 to 5 feet high. Sediments are present throughout the length of the channel and consist primarily of brown coarse to medium sands and silts.

2.6.2 Surface Water and Sediment Sampling Sites in the Background Area

Figure 2 presents the locations of the Phase 1A surface water and sediment background characterization samples. Seventeen surface water and sediment collection sites were previously planned within the background areas. In the event where a proposed site was dry, a surface

water replacement site was chosen based on the criteria for background characterization described in the QAPP. The criteria for the selection of replacement surface water sampling locations is that these locations: (1) are near the MA and the PIA; (2) have similar hydrogeologic characteristics to the Midnite Mine; (3) have not been affected by mining activities; and (4) are accessible for sampling. Sediment samples were collected at each proposed site regardless of whether water was present. Eight proposed sites (SWBK-03, SWBK-05, SWBK-06, SWBK-07, SWBK-08, SWBK-10, SWBK-14, and SWBK-15) were dry. Eight replacement surface water collection sites were subsequently selected and sampled (replacement surface water sampling sites SWBK-17 to SWBK-24). In addition, three sites to the north and west of the Northwest Ridge that were originally proposed as PIA locations (SWNW-01/SDNW-01, SWNW-02/SDNW-02, and SWNW-03/SDNW-03) are representative of background conditions. A detailed description of each background surface water and sediment collection site is provided in Table 4. A general description of the background sampling sites organized by areas of interest is presented below.

Twelve background surface water and sediment collection sites are located along Sand Creek and its tributaries. Six previously planned Sand Creek tributary sites (SWBK-06/SDBK-06, SWBK-07/SDBK-07, SWBK-08/SDBK-08, SWBK-10/SDBK-10, SWBK-14/SDBK-14, and SWBK-15/SDBK-15) were dry during our site visit in September of 1999 and were replaced by seven replacement surface water background sites. Flow measurements were not conducted at three replacement sites (SWBK-18, SWBK-19 and SWBK-20) because of insufficient flow. Sand Creek is a perennial stream located north of the MA and flows southwest to Roosevelt Lake. Sand Creek occupies a definable drainage from 5 to 15 feet wide with vegetated banks from 3 to 8 feet high. Sediments are present throughout the length of the channel and consist primarily of brown medium to coarse sand and cobbles.

Two background surface water and sediment collection sites are located along Blue Creek and three additional collection sites are located on tributaries to Blue Creek that are to the east and upgradient of the mining area. Two Blue Creek tributary sites (SWBK-03/SDBK-03 and SWBK-05/SDBK-05) were dry during our site visit in September of 1999. Flow measurements were not conducted at site SWBK-04. Sediments present at the Blue Creek sampling location consisted of brown coarse to medium sands and silts. Sediments present within the tributaries of Blue Creek consisted of brown medium to coarse gravel with brown sand and silt.

One background surface water and sediment collection site (SWBK-01/SDBK-01) is located approximately 3,000 feet west of the Midnite Mine. This sampling location consists of a small slowly recharging seep that was adsorbed within the ground approximately 25 feet downgradient of its origin. No measurable flow was present at this location. The main drainage that this seep would discharge to is a diffuse channel that occupies a channel approximately 4 to 6 feet wide. Sediment present at this location consisted of light brown silt and pebbles.

Surface water and sediments were collected at each of the three surface water sampling sites to the west and north of the Northwest Ridge. These sites were previously planned as PIA sampling locations. However, water level measurements conducted in the monitoring wells installed on the Northwest Ridge indicated that the ridge is a groundwater divide. Therefore, these locations are now considered to be representative of background conditions. Sites SWNW-01/SDNW-01 and SWNW-02/SDNW-02 are located within a defined channel approximately 1 foot wide with one-foot high vegetated banks. Site SWNW-03/SDNW-03 was a slowly recharging seep and was sampled using the methods described above. Flow

measurements could not be made at this site. A composite and grab sediment sample was collected at each sampling location within the Northwest Ridge area. Sediments present at each of these locations consisted primarily of dark brown silt with cobbles.

Table 1
PIA WELL CONSTRUCTION DETAILS

Well ID	Completion Date	Total Drilled Depth (ft bgs)	Backfilled Depth (ft bgs)	Depth to Bedrock (ft bgs)	Screen Interval (ft bgs)	Screen Slot Size (inches)	Depth to Top of Sand Pack (ft bgs)	Screen Interval Lithology
MWNW-07	9/10/99	150.0	NA	14.0	129.5-149.5	0.03	123.0	quartz monzonite
MWFW-01	9/10/99	31.0	NA	NA	15.0-30.0	0.01	12.8	alluvium
MWFW-02	9/14/99	130.8	NA	26.0	101.9-121.9	0.03	96.8	quartz monzonite
MWFW-03	9/28/99	35.0	NA	1.0	14.5-34.5	0.03	13.0	quartz monzonite
MWFW-04	9/30/99	49.0	NA	5.0	28.0-48.0	0.03	26.0	quartz monzonite
MWFW-05	9/27/99	36.0	NA	6.0	15.0-35.0	0.03	13.0	quartz monzonite
MWSW-01	9/25/99	27.0	NA	22.0	10.0-25.0	0.01	8.0	alluvium/quartz monzonite
MWSW-02	9/12/99	165.0	125.0	18.0	102.0-122.0	0.03	95.0	quartz monzonite
MWWD-01	9/15/99	119.6	NA	15.0	73.4-93.4	0.03	67.8	quartz monzonite
MWWD-02	10/6/99	104.0	71.0	6.0	50.0-70.0	0.03	41.0	quartz monzonite
MWWD-03	10/7/99	56.0	NA	1.0	35.5-55.5	0.03	31.0	quartz monzonite
MWCD-01	10/8/99	117.5	NA	28.0	95.0-115.0	0.03	88.0	quartz monzonite
MWCD-02	9/24/99	116.8	NA	16.0	78.0-98.0	0.03	74.9	quartz monzonite
MWCD-03	10/9/99	64.0	NA	5.0	40.0-60.0	0.03	35.0	calc silicate/aplite
MWED-02	10/8/99	120.0	70.0	14.0	48.0-68.0	0.03	42.0	calc silicate
MWED-03	9/26/99	110.6	53.1	23.0	29.2-49.2	0.03	26.9	calc silicate/marble
MWED-04	9/22/99	119.7	NA	15.0	92.7-112.7	0.03	88.8	quartz monzonite/aplite
MWED-05	10/9/99	27.4	NA	15.0	9.6-24.6	0.01	7.2	alluvium/calc silicate/quartzite
MWED-06	10/9/99	131.0	56.4	15.0	31.0-51.0	0.03	28.2	calc silicate
MWED-07	10/1/99	50.3	45.8	18.0	20.3-40.3	0.03	17.0	quartzite
MWED-08	9/30/99	139.6	90.2	12.0	68.2-88.2	0.03	64.2	quartzite/calc silicate
MWED-09	9/29/99	130.3	117.0	19.0	92.7-112.7	0.03	89.0	calc silicate
MWED-10	9/23/99	16.0	NA	NA	5.0-15.0	0.01	3.0	alluvium
MWED-11	10/11/99	108.9	NA	11.0	87.9-107.9	0.03	81.2	quartz monzonite
MWNE-01	9/26/99	66.0	NA	17.0	39.0-59.0	0.01	35.3	calc silicate
MWNE-02	9/29/99	150.8	NA	16.0	130.2-150.2	0.03	121.0	quartzite/granite
MWNE-03	9/15/99	137.0	NA	117.0	116.5-136.5	0.01	108.0	fill/phyllite schist
MWNE-04	9/24/99	247.0	NA	117.0	217.5-237.5	0.03	209.6	aplite/phyllite schist
MWNE-05	9/25/99	22.0	NA	13.0	5.0-20.0	0.01	3.0	alluvium/calc silicate
MWNE-06	10/7/99	121.7	90.0	13.0	68.0-88.0	0.03	61.5	calc silicate
MWNE-07	9/27/99	89.9	NA	30.0	63.3-83.3	0.03	60.0	calc silicate/marble
MWND-01	9/30/99	76.8	NA	11.0	55.0-75.0	0.03	50.2	phyllite schist

Table 2
BACKGROUND WELL CONSTRUCTION DETAILS

Well ID	Completion Date	Total Drilled Depth (ft bgs)	Backfilled Depth (ft bgs)	Depth to Bedrock (ft bgs)	Screen Interval (ft bgs)	Screen Slot Size (inches)	Depth to Top of Sand Pack (ft bgs)	Screen Interval Lithology
MWBB-01	9/24/99	60.7	NA	20.0	39.5-59.5	0.03	35.0	quartz monzonite
MWBB-02	9/27/99	40.0	NA	1.0	19.5-39.5	0.03	16.0	quartz monzonite
MWBB-03	9/29/99	185.0	NA	1.0	162.0-182.0	0.03	156.0	quartz monzonite
MWBB-04	9/26/99	300.0	NA	1.0	278.0-298.0	0.03	272.0	phyllite schist
MWBB-05	10/11/99	256.0	NA	2.0	235.0-255.0	0.03	228.0	phyllite schist
MWBA-01	9/24/99	21.0	NA	NA	5.0-20.0	0.01	3.0	alluvium
MWBA-02	9/25/99	22.0	NA	6.5	5.0-20.0	0.01	3.0	alluvium/quartz monzonite
MWBA-03	9/25/99	50.0	NA	5.0	33.0-48.0	0.01	31.0	quartz monzonite
MWBA-04	9/25/99	21.0	NA	10.0	5.0-20.0	0.01	3.0	alluvium/quartz monzonite
MWBA-05	9/25/99	22.0	NA	10.0	5.0-20.0	0.01	3.0	alluvium/quartz monzonite
MWBA-06	9/25/99	22.0	NA	NA	5.0-20.0	0.01	3.0	alluvium
MWBA-07	9/24/99	24.0	NA	NA	5.0-20.0	0.01	3.0	alluvium
MWBA-08	10/1/99	21.0	NA	NA	5.0-20.0	0.01	3.0	alluvium
MWBA-09	9/30/99	22.0	NA	21.0	6.0-21.0	0.01	3.0	alluvium
MWBA-10	10/1/99	17.0	NA	15.0	5.0-17.0	0.01	3.0	alluvium/quartzite
MWNW-01	9/11/99	101.0	NA	1.0	80.0-100.0	0.03	73.0	quartz monzonite
MWNW-02	9/13/99	206.0	NA	8.0	180.0-200.0	0.03	172.0	phyllite schist
MWNW-03	9/14/99	120.0	NA	1.0	97.0-117.0	0.03	91.2	phyllite schist
MWNW-04	9/16/99	193.2	NA	1.0	171.0-191.0	0.03	162.0	phyllite schist
MWNW-06	9/22/99	180.0	NA	1.0	157.5-177.5	0.03	150.0	phyllite schist

Table 3
PHASE 1A RI/FS SURFACE WATER AND SEDIMENT SAMPLING LOCATIONS POTENTIALLY IMPACTED AREA

Site ID	Surface Water Sampling Location	Composite Sediment Sampling Location	Grab Sediment Sampling Location	Channel Description
BC01SW / BC01SD	Approximately 30 feet downstream of the USGS Gauging Station in Blue Creek. Survey stake is located along Blue Creek Road.	Composite samples were taken from the surface water sampling location and approximately 170 feet downstream. Both locations are identified along Blue Creek Road with a survey stake.	NA	Blue Creek is perennial with a defined channel approximately 6 feet wide with incised banks. Sediment was a medium brown silt with fines, sands and gravels.
BC04SW / BC04SD	Within Blue Creek approximately 100 feet downstream of its confluence with the unnamed tributary, from which sample TR05SD was collected. Survey stake is located along Blue Creek Road and at sampling location approximately 80 feet to the south.	Composite samples were taken from the surface water sampling location and approximately 240 feet upstream. Both sampling locations are identified along Blue Creek with a survey stake.	NA	Blue Creek is perennial with a defined channel approximately 5 feet wide with incised banks. Sediment was a light brown, coarse to medium sand with fines.
BC05SW / BC05SD	Within Blue Creek approximately 3,000 feet upstream of site BC04SW. Survey stakes are located along Blue Creek Road and at sampling location approximately 50 feet to the east.	Composite samples were taken from the surface water sampling location and approximately 300 feet downstream. The sampling location furthest downstream is not staked.	NA	Blue Creek is perennial with a defined channel approximately 6 feet wide with incised banks. Sediment was a medium brown silt with fines, sands and gravels.
BC09SW / BC09SD	Approximately 10 feet upstream of the USGS Gauging Station in Blue Creek. Survey stakes are located along Blue Creek Road and at the sampling location approximately 100 feet to the south.	Composite samples were taken approximately 10 feet upstream and 210 feet downstream of the surface water sampling location. Neither of the sediment composite locations are staked.	NA	Blue Creek is perennial with a defined channel approximately 6 feet wide with incised banks. Sediment was a light to dark brown coarse sand with fines.
SWBC-01 / SDBC-01	This sampling location was dry during our site visit.	A survey stake is located along the Blue Creek Road approximately 425 feet north of a metal gate to Roosevelt Lake. Within a tributary to Blue Creek approximately 300 feet east of the road is a north south trending barbed wire fence. Approximately 45 feet east of this fence, a survey stake identifies a sampling location. Approximately 300 feet upgradient within this drainage is the second sampling location, which is not staked.	NA	This ephemeral drainage is suspected to originate near the Sherwood Mine. The drainage is poorly defined with light brown sand with cobbles and fines.
SDBC-02	Sediment only was collected at this site.	Approximately 500 feet southeast of the metal gate on Blue Creek Road to Roosevelt Lake, a survey stake is located in the dry beach sands near the mouth of Blue Creek at Roosevelt Reservoir. Composite samples were collected at staked locations approximately 200 feet apart and from a mid point location.	NA	The sampling locations were within approximately 20 feet of exposed dry light brown sand, which passed easily through the number 10-mesh screen.

Table 3
PHASE 1A RI/FS SURFACE WATER AND SEDIMENT SAMPLING LOCATIONS POTENTIALLY IMPACTED AREA

Site ID	Surface Water Sampling Location	Composite Sediment Sampling Location	Grab Sediment Sampling Location	Channel Description
TR04SW / TR04SD	This sampling location was dry during our site visit.	Approximately 50 feet downstream of site BC04SW; there is an unnamed tributary to Blue Creek trending south. Composite sampling locations are staked approximately 100 feet and 335 feet upgradient to this confluence within the unnamed tributary.	NA	This ephemeral drainage occupies a poorly defined channel approximately 2 feet wide with light brown coarse to medium sands with fines.
TR05SW / TR05SD	This sampling location was dry during our site visit.	Approximately 50 feet upstream of site BC04SW; there is an unnamed tributary to Blue Creek trending north. Composite sampling locations are staked approximately 200 feet and 550 feet upgradient to the Blue Creek Road culvert within the unnamed tributary.	NA	This ephemeral drainage is in a defined channel with slightly incised banks. Sediment was a light brown, coarse to medium sand with fines.
TR06SW / TR06SD	A survey stake is located along the Blue Creek Road approximately 1,200 feet north of the culvert crossing of Blue Creek Road for site TR05SD. The sampling location is staked within the Oyachen Creek drainage approximately 350 feet east of Blue Creek. This drainage was dry with the exception of a 4 foot x 4 foot-pooled area of surface water.	Composite samples were taken from the surface water sampling location and approximately 200 feet upgradient within the Oyachen Creek drainage. The furthest upgradient sediment collection site is not marked with a survey stake.	NA	This ephemeral drainage is in a defined channel approximately 6 feet wide with large boulders throughout its floor. The banks were deeply incised up to 5 feet. Sediment was collected from depositional areas between large boulders. Sediment was a light brown, medium to coarse sand with large rocks.
CD SEEP / SDCD-01	A survey stake is located at the base of the south spoils pile at the headwater of the Central Drainage. This site is approximately 75 feet north of a permanent restroom facility near EPA monitoring well # MW2. The seep consists of a 55-gallon pvc drum buried ¾ in the ground with a 4 inch pvc pipe discharging into drum from the north and a 2 inch pvc pipe discharging from the northeast.	Composite samples were taken from the bottom of the buried 55-gallon drum and at a staked location within the central drainage approximately 16 feet east of permanent restroom facility.	NA	The channel downgradient of the seep was very diffuse and heavily vegetated with grasses making it indiscernible. A locked vault located approximately 16 feet east of the permanent restroom facility was receiving discharge, presumably from the seep located approximately 90 feet to the north. Discharge from the vault is unknown. Sediment was a medium brown silt with small cobbles and root debris.
SW-12 / SDCD-02	A survey stake along the road identifies the sampling location approximately 85 feet south of URS Greiner groundwater well #19. Sample was collected from the outfall of a 4-inch pvc pipe extending through a 6-inch thick concrete barrier, which extends the entire width of the drainage.	Composite samples were taken from the surface water sampling location and approximately 20 feet west of URS Greiner groundwater well # 19.	NA	This drainage appears to be largely supplied by seeps. The channel at the northern end of this site occupies a broad u-shaped depression with a poorly definable channel approximately 3 feet wide. Near the concrete retaining wall the drainage becomes channellized approximately 1 foot wide with 2-foot high-vegetated banks. Sediment was a light to dark brown silt with cobbles and root debris.

Table 3
PHASE 1A RI/FS SURFACE WATER AND SEDIMENT SAMPLING LOCATIONS POTENTIALLY IMPACTED AREA

Site ID	Surface Water Sampling Location	Composite Sediment Sampling Location	Grab Sediment Sampling Location	Channel Description
SDCD-03	Sediment only was collected at this site.	A survey stake is located approximately 33 feet west of EPA groundwater well #51. Composite samples were collected approximately 100 feet west of the survey stake within the Central Drainage and 325 feet downgradient. The furthest downgradient sampling location is not marked with a survey stake.	NA	This ephemeral drainage was approximately 3 feet wide, with a poorly defined channel with sloping vegetated banks. Sediment was a light brown silt with cobbles, pebbles and woody debris.
SWCD-01	This sampling location was dry during our site visit. This sampling locating is not collocated with sample location SDCD-03; therefore, a survey stake is located north of the road above location SDCD-03. A survey stake for future surface water collection is located approximately 100 feet upgradient of the road within the Central Drainage.	Surface water only was proposed at this site.	NA	The drainage at the surface water site occupies a channel approximately 2 feet wide with 6-inch high-vegetated banks. This location is upgradient of a road without a culvert, which explains why the channel becomes more diffuse downgradient of the road.
SW-6 / ED01SD	Approximately 4 feet upstream of the USGS Gauging Station in the Eastern Drainage. Survey stake is located along the Eastern Drainage Road and at the sampling location approximately 20 feet to the west. The staff gauge on the USGS Gauging Station read 1.26 feet at the time of our visit.	Composite samples were taken from locations approximately 60 feet upgradient and downgradient from the USGS Gauging Station. Sediment sampling sites are not marked with a survey stake.	NA	The stream occupies a channel approximately 4 feet wide with heavily vegetated banks. The sediments were collected from depositional areas approximately 7 feet wide. Sediment was a dark brown silt with small cobbles and woody debris.
SWED-02 / SDED-04	Approximately 100 feet upgradient of the Central Drainage confluence with the Eastern Drainage a survey stake is located along the Eastern Drainage Road. A survey stake identifies the sampling location approximately 40 feet down the embankment within the drainage.	Composite samples were taken from the surface water sampling location and approximately 60 feet upgradient. The furthest upgradient sediment sampling location is not marked with a survey stake.	NA	The stream occupies a channel approximately 3 feet wide with heavily vegetated banks. The sediments were collected from depositional areas approximately 5 feet wide. Sediment was a dark brown silt with small cobbles and woody debris.
SWED-01 / SDED-03	A survey stake located along the Eastern Drainage Road near monitoring well #37 is approximately 40 feet east of the sampling location within the Eastern Drainage. Approximately 60 feet upgradient of the confluence of an unnamed drainage to the Eastern Drainage is a permanently installed 6-inch throat flume. Surface water samples were collected immediately upgradient of this flume. A survey stake located adjacent to the permanent flume.	Composite samples were taken from the surface water sampling location and approximately 50 feet upgradient. The furthest upgradient sediment sampling location is not marked with a survey stake.	NA	The stream occupies a channel approximately 2.5 feet wide and deeply incised with heavily vegetated banks 2 feet in height. Sediment was a light to dark brown silt with some sands.

Table 3
PHASE 1A RI/FS SURFACE WATER AND SEDIMENT SAMPLING LOCATIONS POTENTIALLY IMPACTED AREA

Site ID	Surface Water Sampling Location	Composite Sediment Sampling Location	Grab Sediment Sampling Location	Channel Description
ED-4 / SDED-02	A survey stake located along the Eastern Drainage Road near monitoring well ED-3 is approximately 30 feet southeast of the sampling location within the Eastern Drainage. The sampling location has been marked with a survey stake.	Composite samples were taken 10 feet and 30 feet upgradient from the surface water sampling location. Sediment collection sites were not marked with a survey stake.	NA	The stream occupies a channel approximately 1.5 feet wide and deeply incised with heavily vegetated banks 2 feet in height. Along a deeply incised (5 feet) secondary bank, approximately 10 feet west of the Eastern Drainage were several active seeps discharging to the Eastern Drainage. Sediment was a light to dark brown silt with some sand and woody debris.
ED-2 / ED04SD	A survey stake is located at the northernmost portion of the Eastern Drainage Road, which parallels the Eastern Drainage before it trends to the east ultimately intersecting the East Haul Road. The sampling location is approximately 30 feet northwest of the survey stake.	Composite samples were taken from the surface water sampling location and approximately 150 feet upgradient. The upgradient sediment sampling location is marked with a survey stake immediately south of a three-strand barbed wire fence.	NA	The stream occupies a channel approximately 3.5 feet wide and deeply incised with heavily vegetated banks 2 feet in height. Sediment was a medium brown to black silt with fines.
ED SEEP / SDED-05	A survey stake is located near a 55-gallon pvc drum buried 7/8 in the ground. A 6 inch pvc pipe discharges into drum from the north and a 2-inch pvc pipe discharges to the east seep pumpback house. Approximately 20 feet south of the east seep pumpback house there are two 2 inch black plastic pipes protruding from the hillside toward the drainage to the south. It is unclear what the purpose of these pipes.	Composite samples were taken below the suspicious 2-inch pipe within the drainage below the east seep pumpback house and approximately 315 feet downgradient. The furthest downgradient sediment sampling location is marked with a survey stake.	NA	The channel immediately downgradient occupies a broad u-shaped depression without a definable channel; however, near the downgradient sediment location the drainage occupies a 2 feet wide channel with 1 foot high banks. Sediment was a light brown with pebbles and fines.
SW-2 / SDED-06	A survey stake is located within the Eastern Drainage approximately 300 feet southeast of URS Greiner monitoring well #06.	Composite samples were taken from the surface water sampling location and approximately 130 feet downgradient. Both sediment sampling locations are marked with a survey stake.	NA	The stream occupies a channel approximately 3 feet wide and deeply incised with heavily vegetated banks 2 feet in height. Sediment was a dark brown to black silt with cobbles and fines.
SDED-01	Within the Eastern Drainage approximately 400 feet east of a survey stake located along the East Haul Road near the blue NPDES pumphouse.	Surface water only was collected at this site.	NA	The stream occupies a channel approximately 3 feet wide and deeply incised with heavily vegetated banks 1 feet in height. Sediment was a dark brown silt with sands and fines.
SDED-07	Sediment only was collected at this site.	Composite samples were taken from three locations along the perimeter of the NPDES outfall pond. The sites were along the north-south trending barbed wire fence to the north of the pond, the northeast corner of the pond and the eastern portion of the pond. Only the eastern sample collection site is marked with a survey stake.	NA	The NPDES discharge volume primarily determines the water level in this approximately 80-foot diameter pond. Sediment was a light brown silt mud with organic debris.

Table 3
PHASE 1A RI/FS SURFACE WATER AND SEDIMENT SAMPLING LOCATIONS POTENTIALLY IMPACTED AREA

Site ID	Surface Water Sampling Location	Composite Sediment Sampling Location	Grab Sediment Sampling Location	Channel Description
OF01SW	A survey stake is located on the NPDES outfall pond access road approximately 60 feet north of the east haul road. Sample was collected from the discharge flow of an 8-inch pbs pipe, which extended 20 feet into the pond from its western edge.	Surface water only was collected at this site.	NA	The NPDES discharge volume primarily determines the water level in this approximately 80-foot diameter pond.
SWFW-01 / SDFW-01	This sampling location was dry during our site visit.	Composite samples were taken within the Far West Drainage approximately 77 feet south of EPA groundwater well #23 and approximately 142 feet further downgradient within the drainage. A survey stake is located along the road south of the groundwater well and at the furthest upgradient sediment sampling location.	NA	This ephemeral drainage originates west of the south spoils waste rock and occupies a u-shaped depression with a definable channel approximately 2 feet wide with vegetated banks 6 inches in height. Sediment was a light brown silty sand.
SWNE-01 / SDNE-01	This sampling location was dry during our site visit.	A survey stake located along the roadside near URS Greiner monitoring well # NE-03 is approximately 50 and 75 feet northwest of two tandem sediment retainment basins. Basins were approximately 25 feet x 20 feet in size. Samples were collected from the posterior of each retainment basin.	NA	Retainment basins are constructed with interlocking 2 feet x 5 feet solid concrete blocks. Sediment was a light brown compacted silt with rocks, cobbles and woody debris.
SWNE-02 / SDNE-02	This sampling location was dry during our site visit.	Composite samples were collected within the Northeastern Drainage approximately 65 feet and 365 feet upgradient of the NPDES outfall pond. Both sampling locations are marked with a survey stake.	NA	This ephemeral drainage originates at the retainment basins located near URS Greiner monitoring well #NE-03 and occupies a u-shaped depression with a definable channel approximately 2 feet wide with 4-inch high banks. Sediment was a light brown silt with pebbles and woody debris.
SWND-01 / SDND-01	This sampling location was dry during our site visit.	Composite samples were collected within the Northern Drainage approximately 100 feet and170 feet downgradient of a survey stake located along the roadside. The site furthest upgradient is marked with a survey stake.	NA	This ephemeral drainage originates at the northernmost portion of the PIA and occupies a definable channel approximately 2 feet wide with vegetated banks 6 inches in height. Sediment was a light brown silt with cobbles and woody debris.
SWSW-01 / SDSW-01	This sampling location was dry during our site visit.	Samples taken from locations within the Southwestern Drainage approximately 10 feet upgradient of the Ford/Wellpinit Road and 50 feet downgradient of a survey marker stake located along the West Access Road to the URS Greiner work yard.	NA	This drainage occupies a definable channel approximately 2 feet wide with vegetated banks 6 inches in height. Sediment was a light brown silt with pebbles, cobbles, woody debris and possible ash material.

Table 3
PHASE 1A RI/FS SURFACE WATER AND SEDIMENT SAMPLING LOCATIONS POTENTIALLY IMPACTED AREA

Site ID	Surface Water Sampling Location	Composite Sediment Sampling Location	Grab Sediment Sampling Location	Channel Description
WD SEEP / SDWD-01	A survey stake is located at the base of the south spoils pile at the headwater of the Western Drainage. This site is approximately 150 feet north of a pumphouse facility near EPA monitoring well # MW1. The site consists of a concrete lined retainment basin with an 8-inch pvc outfall system connected to the pumphouse facility.	Composite samples were collected from each of two small drainages discharging into the concrete retainment basin from the northeast and northwest.	NA	The drainages occupy a channel approximately 1 foot wide with 2-foot high-vegetated banks. Sediment was a light brown silt with small fines.
SWWD-01 / SDWD-02	This sampling location was dry during our site visit.	Composite samples were collected within the Western Drainage approximately 90 and 150 feet upgradient of EPA groundwater well #50. Sample locations are marked with a survey stake.	NA	This drainage occupies a broad u-shaped depression with a channel approximately 3 feet wide. Sediment was a light brown medium sand with fines and woody debris.
WDAC / SDWD-03	A survey stake located at the southernmost portion of the ridgetop between the Western and Central Drainage is approximately 250 feet north of the sampling location. The sampling location is also identified with a survey stake.	Composite samples were taken from the surface water sampling location and approximately 40 feet downgradient within the Western Drainage.	NA	This drainage occupies a channel approximately 2 feet wide with 5-foot high-vegetated banks. Sediment was a medium to dark brown silt with cobbles and root debris.

Table 4
PHASE 1A RI/FS SURFACE WATER AND SEDIMENT SAMPLING LOCATIONS - BACKGROUND AREA

Site ID	Surface Water Sampling Location	Composite Sediment Sampling Location	Grab Sediment Sampling Location	Channel Description
SWBK-01 / SDBK-01	A survey stake is located along a former logging skid trail approximately 3,000 feet west of the URS field office. The sampling location is a slowly recharging seep that the field team excavated the day prior to allow sufficient sample volume to accumulate.	Composite samples were taken approximately 200 and 280 feet downgradient of the seep within the drainage. A survey stake is located at the location nearest to the seep.	Grab sample taken from approximately 200 feet downgradient of the surface water sampling location. The grab sampling location is staked.	Site SWBK-01 was a slowly recharging seep approximately 3 feet x 3 feet in size and the surface water produced was adsorbed into the ground approximately 25 feet downgradient. The drainage occupies a broad u-shaped channel approximately 4 feet wide. Sediment was a light brown silt with sands and gravels.
SWBK-02 / SDBK-02	A survey stake is located along the Ford/Wellpinit Road approximately 2,000 feet east of its intersection with Blue Creek Road. The sampling location is also staked approximately 20 feet south of the Ford/Wellpinit Road.	Composite samples were taken from the surface water sampling location and approximately 200 feet upstream. The upstream sampling location is not staked.	Grab sample taken from approximately 400 feet upstream of the surface water sampling location. The grab sampling location is not staked.	Blue Creek is perennial with a defined channel approximately 6 feet wide with incised banks. The northern bank of this channel was of riprap construction with large boulders. Sediment was medium brown silt with fines, sands and gravels.
SWBK-03 / SDBK-03	A survey stake is located along the east haul road west of URS Greiner monitoring well # MWBA-01. The sampling location is staked within a drainage 150 feet upgradient of a small pond approximately 50 feet x 50 feet in size. This sampling location was dry during our site visit.	Composite samples were taken from the staked surface water sampling location and approximately 300 feet upgradient. Both composite sampling locations are staked.	Grab sample taken from approximately 150 feet upstream of the staked surface water sampling location. The grab sampling location is not staked.	This ephemeral tributary to the pond had a poorly defined channel approximately 3 feet wide with brown coarse to fine sands with some pebbles and gravels.
SWBK-04 / SDBK-04	Approximately 2 miles east of the site on the Ford/Wellpinit Road, is a large open meadow to the north. A survey stake located along the road east of the meadow at a location adjacent to URS Greiner monitoring well # MWBA-04. This sampling location is a small-pooled area upgradient of the road culvert. No other surface water was observed within this drainage.	Composite samples were taken from approximately 66 feet upgradient and 86 feet downgradient of the staked surface water sampling location. Composite sampling locations are not staked.	Grab sample taken from approximately 56 feet upstream of the staked surface water sampling location. The grab sampling location is staked.	This ephemeral drainage contains a defined channel approximately 1 feet wide with vegetated banks 8 inches in height. Sediment was a brown medium to coarse gravel.
SWBK-05 / SDBK-05	A survey stake located along the road approximately 1,000 feet west of URS Greiner monitoring well # MWBA-04. This sampling location is a well-defined drainage that was dry during our site visit.	Composite samples were taken from the staked surface water sampling location and approximately 117 feet downgradient. Both composite sample locations are staked along the road.	Grab sample taken from approximately 150 feet downgradient of the staked surface water sampling location. The grab sampling location is not staked.	This ephemeral drainage contains a defined channel approximately 7 feet wide with vegetated banks 4 foot in height. Sediment was compacted brown silt with woody debris.

Table 4
PHASE 1A RI/FS SURFACE WATER AND SEDIMENT SAMPLING LOCATIONS - BACKGROUND AREA

Site ID	Surface Water Sampling Location	Composite Sediment Sampling Location	Grab Sediment Sampling Location	Channel Description
SWBK-06 / SDBK-06	A survey stake is located along the road on the northwest ridge approximately 1,000 feet north of sampling location SWNW-01. Sample location SWBK-06 was a small-pooled area (approximately 1 feet x 2 feet in size) east of the road. Insufficient sample volume was observed at this location; therefore, no surface water was collected. No other water was observed within this drainage	Composite samples were taken from the staked surface water sampling location and approximately 70 feet upgradient within the primary drainage located 17 feet west of the pooled water. Both composite sample locations are staked.	Grab sample taken from approximately 54 feet upgradient of the staked surface water sampling location. The grab sampling location is not staked.	This ephemeral drainage contains a defined channel approximately 3 feet wide with vegetated banks 1 foot in height. The channel intersects the road approximately 17 feet west of a 4-inch pvc pipe which outfalls runoff downgradient of the road. Sediment was compacted brown silty clay with woody debris.
SWBK-07 / SDBK-07	This sampling location was dry during our site visit.	Composite samples were taken approximately 57 feet upgradient and 165 feet downgradient of the SWBK-07 hub stake. Both composite sample locations are staked.	Grab sample taken from approximately 110 feet downgradient of the SWBK-07 hub stake. The grab sampling location is not staked.	This ephemeral drainage occupies a channel approximately 2 to 4 feet wide with vegetated banks approximately 1 foot in height. Sediment present was light brown sandy silt with cobbles and large rocks.
SWBK-08 / SDBK-08	This sampling location was dry during our site visit.	Composite samples were taken approximately 1,000 and 1,200 feet downgradient of an unnamed drainage downgradient of URS Greiner monitoring well # MWBB-05. Both composite sample locations are staked.	Grab sample taken approximately 1,100 feet downgradient of an unnamed drainage downgradient of URS Greiner monitoring well # MWBB-05. The grab sample location is not staked.	This drainage contains several flat terraces, possibly remnants of former logging roads. The drainage occupies a channel approximately 3 feet wide with incised banks varying from 1 to 6 feet in height. Sediment was medium brown silt with cobbles, and woody debris.
SWBK-09 / SDBK-09	A survey stake is located along Sand Creek Road. The staked sampling location is within sand creek approximately 60 feet southeast of the road.	Composite samples were taken approximately 35 feet upgradient and 40 feet downgradient of the surface water sampling location. Neither composite sample locations are staked.	Grab sample taken from the surface water sampling location.	Sand Creek is perennial with a defined channel approximately 6 feet wide with incised banks. Sediment was medium brown coarse sand.
SWBK-10 / SDBK-10	This sampling location was dry during our site visit.	Approximately 2,000 feet downgradient of sampling location SWBK-08, the drainage intersects Sand Creek. Composite samples were taken within this drainage approximately 30 feet and 150 feet upgradient of Sand Creek within this unnamed drainage. A survey stake is located along Sand Creek Road approximately 2,000 feet upgradient of location SWBK-09. Neither composite sample locations are staked.	Grab sample taken from approximately 250 feet upgradient of the Sand Creek within the unnamed drainage.	The channel at the southern end of this site occupies a broad u-shaped depression with a poorly definable channel approximately 3 feet wide. Near the confluence with Sand Creek the drainage becomes channeled approximately 2 foot wide with 4-foot high-vegetated banks. Sediment was a light to dark brown silt.

Table 4
PHASE 1A RI/FS SURFACE WATER AND SEDIMENT SAMPLING LOCATIONS - BACKGROUND AREA

Site ID	Surface Water Sampling Location	Composite Sediment Sampling Location	Grab Sediment Sampling Location	Channel Description
SWBK-11 / SDBK-11	A survey stake is located within a tributary of Sand Creek approximately 300 feet upgradient of its confluence.	Composite samples were taken from within the drainage road approximately 170 and 250 feet upgradient of its confluence with Sand Creek. Composite sampling location are not staked.	Grab sample taken from staked location approximately 200 feet upgradient of the confluence with Sand Creek. The grab sample location is not staked.	This ephemeral drainage is in a defined channel approximately 3 feet wide with vegetated banks approximately 1 foot in height.
SWBK-12 / SDBK-12	A survey stake is located along Sand Creek. The staked sampling location is within sand creek approximately 200 feet southeast of Sand Creek Road.	Composite samples were taken approximately 100 feet upgradient and 80 feet downgradient of the surface water sampling location. Composite sample locations are not staked.	Grab sample taken from approximately 30 feet downgradient of the surface water sampling location. The grab sample location is not staked.	Sand Creek is perennial with a defined channel approximately 6 feet wide with incised banks. Sediment was medium brown coarse sand.
SWBK-13 / SDBK-13	A survey stake is located along Sand Creek Road. The staked sampling location is within sand creek approximately 200 feet southeast of the road.	Composite samples were taken approximately 20 feet and 100 feet downgradient of the staked surface water sampling location. Neither composite sample locations are staked.	Grab sample taken from approximately 80 feet downgradient of the surface water sampling location. The grab sample location is not staked.	Sand Creek is perennial with a defined channel approximately 6 feet wide with incised banks. Sediment was medium brown coarse sand with cobbles.
SWBK-14 / SDBK-14	This sampling location was dry during our site visit.	This sampling location is within a tributary to Sand Creek immediately downgradient of URS Greiner monitoring well # MWBNA-05. A survey stake is located along the road and Composite samples were taken approximately 59 feet and 150 feet downgradient of the survey stake.	Grab sample taken within a tributary of Sand Creek approximately 90 feet downgradient of the survey stake. The grab sample location is not staked.	This ephemeral drainage is in a defined channel approximately 2 feet wide banks incised up to 2 feet in height. Sediment was a dark brown, organic soil with silt and woody debris.
SWBK-15 / SDBK-15	This sampling location was dry during our site visit.	A survey stake is located along Bia Hwy 51 approximately 1,000 feet north of its intersection with Sand Creek Road. The sampling location is within a drainage upgradient of this road. This drainage is a tributary to Sand Creek. Composite samples were taken approximately 5 feet and 120 feet upgradient of the road. Both composite sampling locations are staked	Grab sample taken approximately 175 upgradient of the road. Grab sampling location is not staked.	This ephemeral drainage is in a defined channel approximately 2 feet wide banks incised up to 1 feet. Sediment was a medium brown, organic soil with silt and woody debris.

Table 4
PHASE 1A RI/FS SURFACE WATER AND SEDIMENT SAMPLING LOCATIONS - BACKGROUND AREA

Site ID	Surface Water Sampling Location	Composite Sediment Sampling Location	Grab Sediment Sampling Location	Channel Description
SWBK-16 / SDBK-16	A survey stake is located along Bia Hwy 51 at its intersection with Bia Hwy 3. This sampling location is approximately1 mile north on Bia Hwy 51 from Sand Creek Road. The staked sampling location is within a tributary of Sand Creek immediately downgradient of the road.	Composite samples were taken from the surface water sampling location and approximately 75 feet downstream. Both composite sampling locations are staked.	Grab sample taken approximately 25 downgradient of the road. Grab sampling location is not staked.	This perennial drainage has a defined channel approximately 6 feet wide with incised banks. Sediment was medium brown silt with fines, sands and gravels.
SWBK-17	This is a replacement background surface water sample location. A survey stake is located along an unimproved road approximately 2,000 southwest of site SWBK-13. The sampling location is within a small tributary of Sand Creek upgradient of the road.	No sediments were collected at this site.	NA	This drainage occupies a channel approximately 2 feet wide with 1 foot incised banks
SWBK-18	This is a replacement background surface water sample location. This staked sampling location is approximately 1,000 feet upgradient of site SWBK-07. The sampling location was a pooled area approximately 15 feet x 20 feet in size.	No sediments were collected at this site.	NA	This pooled area was located within the same drainage as site SWBK-07. Sampling location was a pooled area approximately 15 feet x 20 feet in size and supplied by a seep. The banks of the pooled area had been bermed approximately 3 feet high.
SWBK-19	This is a replacement background surface water sample location. A survey stake is located along Sand Creek Road approximately 1,000 feet north of site SWBK-13. The sampling location is a seep within a tributary to Sand Creek. This seep had been excavated to approximately 3 feet x 4 feet the day prior to allow sufficient sample volume to accumulate.	No sediments were collected at this site.	NA	This slowly recharging seep is located within a broad u-shaped drainage with a defined channel approximately 1 foot wide.
SWBK-20	This is a replacement background surface water sample location. A survey stake is located along Sand Creek Road approximately 3,000 feet downgradient of site SWBK-13. This sampling location is within a tributary to Sand Creek immediately downgradient of Sand Creek Road. Sample was collected from a residual pooled area approximately 5 feet x 5 feet in size.	No sediments were collected at this site.	NA	This drainage occupies a defined channel approximately 10 feet wide with 5-foot high-vegetated banks. The drainage floor contained several large boulders.

Table 4
PHASE 1A RI/FS SURFACE WATER AND SEDIMENT SAMPLING LOCATIONS - BACKGROUND AREA

Site ID	Surface Water Sampling Location	Composite Sediment Sampling Location	Grab Sediment Sampling Location	Channel Description
SWBK-21	This is a replacement background surface water sample location. A survey stake is located along Sand Creek Road approximately 1,000 feet west of site SWBK-09. This sampling location is within Owl Creek, which is a tributary to Sand Creek. Sample was collected approximately 10 feet upgradient of Sand Creek Road.	No sediments were collected at this site.	NA	This drainage occupies a channel approximately 2 feet wide with 1-foot high-vegetated banks.
SWBK-22	This is a replacement background surface water sample location. . A survey stake is located along Sand Creek Road at its crossing of Rail Creek, a tributary of Sand Creek. This sampling location is approximately 15 feet upgradient of Sand Creek Road.	No sediments were collected at this site.	NA	This drainage occupies a channel approximately 2 feet wide with 1-foot high-vegetated banks.
SWBK-23	This is a replacement background surface water sample location. A survey stake is located near a seep approximately 100 feet south of URS Greiner monitoring well # MWBB-01. The pooled area of the seep is approximately 5 feet x 6 feet in size.	No sediments were collected at this site.	NA	This seep is located within a broad u-shaped drainage with a defined channel approximately 1 foot wide.
SWBK-24	This is a replacement background surface water sample location. A survey stake is located along Bia Hwy 51 approximately 1,000 feet north of site SWBK-15. This sampling location is a tributary to Sand Creek.	No sediments were collected at this site.	NA	This perennial drainage has a defined channel approximately 6 feet wide with incised banks.
BC10SW / BC10SD	A survey stake is located along the Ford/Wellpinit Road approximately 50 feet east of its intersection with Blue Creek Road. The sampling location is also staked approximately 60 feet south of the Ford/Wellpinit Road.	Composite samples were taken from the surface water sampling location and approximately 240 feet upstream. The upstream sampling location is not staked.	NA	Blue Creek is perennial with a defined channel approximately 4 feet wide with incised banks. Sediment was brown with medium to fine sands

Table 4
PHASE 1A RI/FS SURFACE WATER AND SEDIMENT SAMPLING LOCATIONS - BACKGROUND AREA

Site ID	Surface Water Sampling Location	Composite Sediment Sampling Location	Grab Sediment Sampling Location	Channel Description
SWNW-01 / SDNW-01	A survey stake is located north of the dirt road within an unnamed drainage near a pooled area 5 feet x 6 feet in size resulting from seeps located immediately upgradient.	Composite samples were taken within the unnamed drainage at the surface water sampling location and approximately 100 feet upgradient. The second sediment collection site is marked approximately 25 feet east of a survey stake located along a former logging skid trail to the west of the drainage.	Sample was collected immediately upgradient of the northernmost composite sediment sampling location.	This drainage occupies a broad u-shaped depression with a poorly definable channel in the upper portion of the drainage. Near the road, the drainage becomes channeled approximately 1 foot wide with 2 feet high-vegetated banks. Sediment was a dark brown organic with root fragments.
SWNW-02 / SDNW-02	A survey stake is located north of the dirt road near a pooled area 7 feet x 8 feet in size resulting from seeps located immediately upgradient within an unnamed drainage.	Samples taken from locations approximately 50 feet and 150 feet upgradient of the pooled area within the unnamed drainage. The sediment sampling location nearest the pooled area is marked with a survey stake.	Sample was collected immediately upgradient of the composite sampling location approximately 150 feet from the pooled area.	This drainage occupies a definable channel approximately 2 feet wide with vegetated banks 6 inches in height. Sediment was a dark brown silty loam with cobbles.
SWNW-03 / SDNW-03	The sampling location is within an unnamed drainage approximately 50 feet east of a survey stake located along the dirt road. To obtain sufficient sample from this slowly recharging seep, a 3 feet x 3 feet pit was excavated and lined with plastic.	Samples taken from locations 20 feet upgradient of the road and approximately 20 feet upgradient of the surface water collection location within a small drainage intersecting the main drainage from the southeast.	Sample was collected approximately 35 feet upgradient of the surface water collection site within the main drainage.	This drainage occupies a definable channel approximately 4 feet wide with 1foot high-vegetated banks. Sediment was a dark brown silty loam with cobbles and large rocks.

Twenty monitoring wells were installed for the background investigation as described above. Preliminary statistical analysis of the data obtained from sampling of these wells has been performed for major and trace metals, anions, and water quality parameters. Results of the radiological analyses have not yet been received from the laboratory. The preliminary analysis indicates that there is a significant statistical difference between the alluvial and bedrock water chemistry. Therefore, the alluvial and bedrock background data sets were analyzed separately and compared to the appropriate monitoring well data collected in the PIA to identify areas that have been impacted by the Midnite Mine.

Sixteen surface water and 16 sediment locations were sampled for the background investigation, as described above. In addition, one location on Blue Creek that is upgradient of the confluence with the mine drainage stream (BC10SW/BC10SD) and the three Northwest Ridge sampling locations are considered to be representative of background conditions for surface water and sediments. Both grab and composite sediment samples were collected at each background location (except BC10SD) in order to provide data comparable to that collected by previous investigations.

The preliminary 95% Upper Tolerance Levels (UTLs) for the Phase 1A Round 1 samples for trace metals, major ions, and water quality parameters were calculated as described in the QAPP. The statistical methods used and the preliminary 95% UTLs for alluvial groundwater, bedrock groundwater, surface water, grab sediments, and composite sediments were presented in the Technical Memorandum entitled "Preliminary Background Limits and Site Comparison to Background Limits" dated June 9, 2000. The 95% UTLs presented in the Technical Memorandum are only preliminary at this time and will be revised after Round 2 data have been received. UTLs for the radiological parameters will also be calculated when the data become available. The results from the finalized statistical evaluation of the Round 1 background samples will be compared to those derived from the Round 2 samples collected during April of 2000 to evaluate whether seasonal variations in the background concentrations of metals, radionuclides, and other inorganic parameters are significant. These evaluations will be conducted to determine whether additional sample locations or sampling events are desirable for the purposes of this study.

The conceptual hydrogeologic model of the Midnite Mine consists of moderately conductive waste rock and alluvium that overlie less conductive weathered and fractured quartz monzonite and other intrusive phases, phyllite, and calc-silicate formations. Recharge to the system is from precipitation falling on the mine site and the Northwest Ridge. The majority of the water that infiltrates to form groundwater at the site moves through the waste rock and alluvium and flows across the surface of the bedrock. During passage through the waste rock, the water reacts with minerals in the rock which contribute radionuclides, metals, and major ions such as sulfate to the groundwater. Much of this water discharges at three major seeps along the south face of the South Spoils waste rock. A minor portion of the contaminated groundwater infiltrates into the bedrock and moves to the south from the disturbed area.

4.1 GEOLOGIC CONTROLS ON GROUNDWATER FLOW

Groundwater in the PIA and MA flows through natural and disturbed unconsolidated materials and bedrock. Unconsolidated materials at the site consist of alluvium, waste rock, and ore/protore stockpiles. Groundwater movement within the unconsolidated materials generally occurs by porous flow and is controlled by the bulk hydraulic conductivity of the material. Waste rock from the mining operations was deposited across several existing drainages in the MA (the northern extensions of the Western, Central, and Eastern Drainages). These buried drainages likely act to channel flow within the unconsolidated materials. It has been suggested (Peters 1999; Williams et al. 1996) that buried haul roads in the MA also act to channel water across the bedrock surface. A geophysical survey conducted by Williams et al. (1996) identified flow paths from the MA to the Central Drainage seep that were attributed to the presence of decreased hydraulic conductivity due to crushing and compacting of rock along haul roads.

Groundwater flow within the bedrock at the site is through discrete fractures, joints, and faults. The U.S. Bureau of Mines performed a visual reconnaissance of the three main bedrock rock types on the mine site to evaluate the relative conductivity of each (Williams et al. 1996). Based on fracture density, width, and orientation, the calc-silicate rocks have the lowest relative hydraulic conductivity and the quartz monzonite the highest. The phyllite schist also appeared to have a low matrix hydraulic conductivity, however, intrusive dikes within the phyllite are weathered and may locally channel groundwater along their strike. Water-bearing dikes were encountered in several boreholes drilled for monitoring well installation for the Phase 1A field investigation.

Slug testing and pump testing of wells completed in the bedrock was performed by Williams and Riley (1996). Values of hydraulic conductivity calculated for the bedrock range from 2×10^{-6} to 7×10^{-5} feet per minute. The lowest conductivity was measured in unfractured bedrock whereas the highest conductivity was associated with wells completed in fractured bedrock. This study also found that major geologic structures at the mine site may act as preferred flow paths in the bedrock. One such structure, sometimes referred to as the Midnite Fault, extends through Pit 4 to the south to Pit 3. Seeps of water are present on the north highwall of Pit 3 at the location of this structure.

4.2 VERTICAL HYDRAULIC GRADIENTS

Monitoring wells were installed at the site during the Phase 1A field investigation in both alluvium and bedrock. Some bedrock wells were installed to target the elevation of the

potentiometric surface (water-table bedrock wells) and others were installed to target deep groundwater flow paths below the water table. Deep wells were also installed next to several existing water table wells. Water level data from adjacent wells completed as a pair with one well screened at the water table and one screened below the water table can be used to evaluate the vertical hydraulic gradients. Knowledge of the vertical gradients is necessary to evaluate the fate of contaminants in the groundwater at the site. Table 5 presents vertical gradients calculated for the thirteen well pairs installed in the PIA.

Ten well pairs were completed with one well screened in alluvium or across the alluvium/bedrock contact and the other well screened in bedrock. Seven of the ten well pairs (MWSW-01/MWSW-02; MWNE-05/MWNE-06; MW-6/MWED-02; MW-4/MWED-04; MW-1/MWWD-01; MW-2/MWCD-01; and MWED-10/MWED-11) show a slight downward gradient from the alluvium into the underlying bedrock with the difference in head values ranging from 0.11 to 6.87 feet (Table 5). The remaining three well pairs (MWFW-01/MWFW-02; MW-5/MWED-03; and GW-19/MWCD-02) show an upward gradient from the bedrock into the overlying alluvium (1.01 to 4.58 feet difference in head).

Two well pairs were constructed with one well screened in shallow bedrock and the other well screened in the deep bedrock approximately 100 feet deeper. Well pair MWNE-01/MWNE-02, completed in a fracture zone at the head of the Northeastern Drainage, shows a slight upward vertical gradient of 1.24 feet. Well pair MWED-07/MWED-08 shows a downward gradient of 5.89 feet. This well pair is completed near the East Seep, along an intermittent drainage that feeds the Eastern Drainage.

Well pair MWNE-03/MWNE-04 was completed with one well screened in fill material and the other well screened in the underlying bedrock to the east of Pit 4. A downward gradient of 0.54 feet was measured in this well pair.

In summary, no consistent pattern of vertical gradients in the PIA is evident from the data available at this time. Instead, the gradients measured appear to reflect local conditions such as the presence of fracture zones.

4.3 POTENTIOMETRIC MAP

Water levels were measured in all new and existing wells across the site during the Round 1 sampling event. Groundwater elevations for wells that monitor the water table were plotted against ground surface elevations to establish the degree of correlation between these two parameters (Figure 4). This analysis indicates a strong correlation between groundwater elevations and ground surface elevations ($R^2 = 0.99$). This correlation demonstrates that groundwater is controlled primarily by the ground surface topography and that the fractured bedrock flow system behaves as an equivalent porous medium on a large scale. The empirical relationship between topography and groundwater elevations was used to estimate the potentiometric surface in areas where measured groundwater elevation data was sparse or lacking.

Figure 5 presents the potentiometric map for the fall of 1999. Bolded arrows on the map indicate the local flow direction at various parts of the site. The map shows that groundwater at the site generally flows from north to south and the potentiometric surface mimics the topography. The groundwater flow directions indicated on the map suggest that groundwater at the site converges

into the drainages that flow toward Blue Creek. Under current conditions, Pits 3 and 4 may both serve as groundwater sinks for water in the immediate area. However, the pits may have historically been sources to downgradient contamination when pit lake levels were higher. The data also indicate that the Northwest Ridge is a groundwater divide and that all flow from Pit 4 is towards the south through the Mined Area or to the southeast into the Northeastern Drainage. Groundwater flow in the Northeastern Drainage follows the course of the Eastern Drainage and eventually reports to Blue Creek.

Table 5
VERTICAL HYDRAULIC GRADIENTS CALCULATED FROM THE PHASE 1A ROUND 1 WATER LEVEL MEASUREMENTS

Monitoring Well Pair ID	Geologic units monitored	Shallow Well Water Elevation (ft amsl)	Deep Well Water Elevation (ft amsl)	Vertical Gradient (ft)
MWFW-01/ MWFW-02	Alluvium/bedrock	2511.92	2515.10	3.18
MWSW-01/ MWSW-02	Alluvium/bedrock	2431.53	2424.77	-6.76
MWNE-05/ MWNE-06	Alluvium/bedrock	2641.65	2637.49	-4.16
MW-6/ MWED-02	Alluvium/bedrock	2640.65	2640.27	-0.38
MW-5/ MWED-03	Alluvium/bedrock	2456.83	2457.84	1.01
MW-4/ MWED-04	Alluvium/bedrock	2360.94	2359.76	-1.18
MW-1/ MWWD-01	Alluvium/bedrock	2402.29	2399.18	-3.11
MW-2/ MWCD-01	Alluvium/bedrock	2428.43	2421.56	-6.87
GW-19/ MWCD-02	Alluvium/bedrock	2312.05	2316.63	4.58
MWED-10/ MWED-11	Alluvium/bedrock	2129.10	2128.99	-0.11
MWNE-01/ MWNE-02	Bedrock/deep bedrock	3082.51	3083.75	1.24
MWED-07/ MWED-08	Bedrock/deep bedrock	2588.66	2582.77	-5.89
MWNE-03/ MWNE-04	Fill/bedrock	3023.71	3023.17	-0.54

(1) A positive value indicates an upward vertical gradient and a negative value indicates a downward vertical gradient.

Preliminary unvalidated analytical results for total and dissolved metals, major ions, and water quality parameters are available for the groundwater, surface water, and sediment samples collected during the Phase 1A Round 1 sampling event conducted during the fall of 1999. Results of the radiological analyses have yet to be received. The preliminary results were screened against the preliminary background 95% UTLs. Based on a preliminary review of the background data, there appears to be a statistically significant difference for many parameters between alluvial and bedrock groundwater. Therefore, alluvial PIA wells were compared against the preliminary 95% UTLs for the alluvial background wells and PIA bedrock wells were compared against the preliminary 95% UTLs for the bedrock background wells. Seeps were compared to the bedrock 95% UTLs. Parameters that exceed the preliminary 95% UTLs are listed in Table 6. Exceedances of selected parameters (nitrate, sulfate, phosphate, and trace metals) are also shown on Figures 6, 7, and 8 for groundwater (including seeps), surface water, and sediments within the PIA, respectively.

Figure 6 shows that the highest concentrations of sulfate, cadmium, cobalt, manganese, nickel, and zinc were found in the samples from the three seeps south of the South Spoils (WD Seep, Dam Toe Seep, and East Seep). Concentrations of these parameters in the alluvium south of the MA are typically higher than those found in the paired bedrock wells, and decrease towards Blue Creek. Only a few exceedances were noted for wells completed in the Far West, Southwest, and Northeast Drainages, and no exceedances occurred for the well completed at the head of the Northern Drainage.

Figure 7 shows that all exceedances of trace metals and anions in surface water samples collected during the fall of 1999 are associated with samples collected in the Eastern Drainage and in the drainages south of the MA. The Far West, Southwest, Northern, and Northeast drainages were dry during the sampling event. The highest concentrations of sulfate are found in the Eastern Drainage, whereas the highest concentrations of trace metals were found in the Central and Western Drainages. Sulfate was recorded in the water treatment plant outfall (sample location OF01SW) at concentrations similar to those found throughout the Eastern Drainage, suggesting that the source of much of the sulfate is the treatment plant effluent. However, sulfate is also high in the Central and Western Drainages and in the three seeps (see Figure 6). Blue Creek exceeds the preliminary 95% UTLs for sulfate and nitrate throughout its length, with only a few exceedances of trace metals.

Figure 8 shows that much of the sediment sampled in the Eastern, Western, and Central Drainages during the fall of 1999 exceeds the preliminary 95% UTLs for composite sediments for sulfate and trace metals. The concentrations of trace metals generally increases towards the south and are highest in the Eastern Drainage south of the confluences with the Western and Central Drainages. Sulfate is elevated above background for the length of Blue Creek, but exceedances of trace metals were only observed in Blue Creek at sample location BC09SD, immediately downgradient of the mine drainage stream outlet. Sediments in the Far West and Southwest Drainages appear to be unimpacted by the mining activities.

Table 6
PHASE 1A ROUND 1 PIA ANALYTICAL RESULTS
THAT EXCEED PRELIMINARY 95% UTLs

Sample Location ID	Analyte	Value	Units
Groundwater			
GW-19	Beryllium	0.34	ug/l
GW-19	Cadmium	8	ug/l
GW-19	Calcium	295000	ug/l
GW-19	Magnesium	144000	ug/l
GW-19	Manganese	24800	ug/l
GW-19	Nickel	353	ug/l
GW-19	Potassium	6100	ug/l
GW-19	Sodium	35100	ug/l
GW-19	Chloride	2.41	mg/l
GW-19	Hardness	1360	mg/l
GW-19	Nitrate	3.19	mg/l
GW-19	Sulfate	1230	mg/l
GW-19	Total Dissolved Solids	2110	mg/l
GW-35A	Aluminum	5400	ug/l
GW-35A	Beryllium	14	ug/l
GW-35A	Cadmium	10.5	ug/l
GW-35A	Calcium	491000	ug/l
GW-35A	Cobalt	27.7	ug/l
GW-35A	Copper	4.9	ug/l
GW-35A	Magnesium	319000	ug/l
GW-35A	Manganese	39600	ug/l
GW-35A	Nickel	590	ug/l
GW-35A	Potassium	8090	ug/l
GW-35A	Sodium	41700	ug/l
GW-35A	Zinc	991	ug/l
GW-35A	Chloride	2.71	mg/l
GW-35A	Hardness	2541	mg/l
GW-35A	Nitrate	1.08	mg/l
GW-35A	Sulfate	2470	mg/l
GW-35A	Total Dissolved Solids	3740	mg/l
GW-36A	Cadmium	12.8	ug/l
GW-36A	Calcium	291000	ug/l
GW-36A	Magnesium	147000	ug/l
GW-36A	Manganese	33500	ug/l
GW-36A	Nickel	377	ug/l
GW-36A	Sodium	34300	ug/l
GW-36A	Zinc	300	ug/l
GW-36A	Chloride	2.18	mg/l
GW-36A	Hardness	1286	mg/l
GW-36A	Nitrate	2.14	mg/l
GW-36A	Sulfate	1200	mg/l
GW-36A	Total Dissolved Solids	1960	mg/l
GW-50	Barium	108	ug/l
GW-50	Calcium	123000	ug/l
GW-50	Sodium	38200	ug/l
GW-50	Alkalinity, Total	188	mg/l
GW-50	Chloride	1.32	mg/l

Table 6
PHASE 1A ROUND 1 PIA ANALYTICAL RESULTS
THAT EXCEED PRELIMINARY 95% UTLs

Sample Location ID	Analyte	Value	Units
GW-50	Hardness	388	mg/l
GW-51	Barium	56.8	ug/l
GW-51	Calcium	162000	ug/l
GW-51	Magnesium	40700	ug/l
GW-51	Potassium	4250	ug/l
GW-51	Sodium	24700	ug/l
GW-51	Alkalinity, Total	204	mg/l
GW-51	Chloride	2.16	mg/l
GW-51	Hardness	621	mg/l
GW-51	Sulfate	460	mg/l
GW-51	Total Dissolved Solids	868	mg/l
MW-1	Aluminum	10200	ug/l
MW-1	Beryllium	12.8	ug/l
MW-1	Cadmium	10.7	ug/l
MW-1	Calcium	446000	ug/l
MW-1	Cobalt	217	ug/l
MW-1	Copper	26.3	ug/l
MW-1	Magnesium	327000	ug/l
MW-1	Manganese	39500	ug/l
MW-1	Nickel	611	ug/l
MW-1	Potassium	7250	ug/l
MW-1	Sodium	41300	ug/l
MW-1	Zinc	1080	ug/l
MW-1	Chloride	2.71	mg/l
MW-1	Hardness	2510	mg/l
MW-1	Nitrate	1.45	mg/l
MW-1	Sulfate	2750	mg/l
MW-1	Total Dissolved Solids	3770	mg/l
MW-2	Calcium	548000	ug/l
MW-2	Iron	4830	ug/l
MW-2	Magnesium	149000	ug/l
MW-2	Potassium	5790	ug/l
MW-2	Sodium	65800	ug/l
MW-2	Alkalinity, Total	241	mg/l
MW-2	Chloride	3.01	mg/l
MW-2	Hardness	1973	mg/l
MW-2	Sulfate	1880	mg/l
MW-4	Calcium	175000	ug/l
MW-4	Magnesium	41800	ug/l
MW-4	Vanadium	3.2	ug/l
MW-4	Alkalinity, Total	242	mg/l
MW-4	Chloride	2.28	mg/l
MW-4	Hardness	649	mg/l
MW-4	Nitrate	7.67	mg/l
MW-4	Sulfate	364	mg/l
MW-4	Total Dissolved Solids	3020	mg/l
MW-5	Calcium	563000	ug/l
MW-5	Magnesium	143000	ug/l

Table 6
PHASE 1A ROUND 1 PIA ANALYTICAL RESULTS
THAT EXCEED PRELIMINARY 95% UTLs

Sample Location ID	Analyte	Value	Units
MW-5	Potassium	8560	ug/l
MW-5	Sodium	27800	ug/l
MW-5	Chloride	2.44	mg/l
MW-5	Hardness	2017	mg/l
MW-5	Nitrate	1.44	mg/l
MW-5	Sulfate	1790	mg/l
MW-5	Total Dissolved Solids	2920	mg/l
MW-6	Magnesium	10700	ug/l
MW-6	Selenium	1.4	ug/l
MW-6	Total Dissolved Solids	281	mg/l
MWCD-01	Barium	52.4	ug/l
MWCD-01	Sodium	53500	ug/l
MWCD-01	Alkalinity, Total	160	mg/l
MWCD-02	Barium	93.1	ug/l
MWCD-02	Calcium	53000	ug/l
MWCD-02	Sodium	27500	ug/l
MWCD-02	Thallium	1.6	ug/l
MWCD-02	Alkalinity, Total	196	mg/l
MWED-02	Calcium	61400	ug/l
MWED-02	Alkalinity, Total	200	mg/l
MWED-02	Hardness	207	mg/l
MWED-03	Antimony	5.2	ug/l
MWED-03	Calcium	312000	ug/l
MWED-03	Chromium	16.9	ug/l
MWED-03	Magnesium	67200	ug/l
MWED-03	Alkalinity, Total	201	mg/l
MWED-03	Chloride	1.99	mg/l
MWED-03	Hardness	977	mg/l
MWED-03	Sulfate	807	mg/l
MWED-03	Total Dissolved Solids	1440	mg/l
MWED-04	Barium	42.8	ug/l
MWED-04	Sodium	34400	ug/l
MWED-04	Alkalinity, Total	101	mg/l
MWED-04	Chloride	1.52	mg/l
MWED-06	Cadmium	5.3	ug/l
MWED-06	Calcium	524000	ug/l
MWED-06	Magnesium	282000	ug/l
MWED-06	Manganese	11500	ug/l
MWED-06	Nickel	252	ug/l
MWED-06	Potassium	6740	ug/l
MWED-06	Sodium	39600	ug/l
MWED-06	Zinc	499	ug/l
MWED-06	Chloride	2.57	mg/l
MWED-06	Hardness	2503	mg/l
MWED-06	Sulfate	2475	mg/l
MWED-06	Total Dissolved Solids	3460	mg/l
MWED-07	Barium	60.7	ug/l
MWED-07	Calcium	436000	ug/l

Table 6
PHASE 1A ROUND 1 PIA ANALYTICAL RESULTS
THAT EXCEED PRELIMINARY 95% UTLs

Sample Location ID	Analyte	Value	Units
MWED-07	Magnesium	142000	ug/l
MWED-07	Potassium	7800	ug/l
MWED-07	Sodium	62100	ug/l
MWED-07	Alkalinity, Total	226	mg/l
MWED-07	Chloride	2.29	mg/l
MWED-07	Hardness	1635	mg/l
MWED-07	Nitrate	2.17	mg/l
MWED-07	Sulfate	1590	mg/l
MWED-07	Total Dissolved Solids	2470	mg/l
MWED-08	Calcium	269000	ug/l
MWED-08	Magnesium	98800	ug/l
MWED-08	Potassium	6780	ug/l
MWED-08	Sodium	25300	ug/l
MWED-08	Alkalinity, Total	198	mg/l
MWED-08	Chloride	1.75	mg/l
MWED-08	Hardness	1087	mg/l
MWED-08	Nitrate	3.74	mg/l
MWED-08	Sulfate	1004	mg/l
MWED-08	Total Dissolved Solids	1670	mg/l
MWED-09	Calcium	144000	ug/l
MWED-09	Magnesium	54300	ug/l
MWED-09	Potassium	6130	ug/l
MWED-09	Alkalinity, Total	235	mg/l
MWED-09	Chloride	2.33	mg/l
MWED-09	Hardness	586	mg/l
MWED-09	Sulfate	856	mg/l
MWED-09	Total Dissolved Solids	811	mg/l
MWED-10	Calcium	683000	ug/l
MWED-10	Magnesium	106000	ug/l
MWED-10	Nickel	24.8	ug/l
MWED-10	Potassium	6110	ug/l
MWED-10	Sodium	38300	ug/l
MWED-10	Chloride	3.22	mg/l
MWED-10	Hardness	2102	mg/l
MWED-10	Sulfate	2170	mg/l
MWED-10	Total Dissolved Solids	3250	mg/l
MWED-11	Barium	64.1	ug/l
MWED-11	Sodium	34700	ug/l
MWED-11	Thallium	1.2	ug/l
MWED-11	Alkalinity, Total	137	mg/l
MWED-11	Chloride	1.24	mg/l
MWFW-01	Nickel	19.2	ug/l
MWFW-01	Chloride	1.97	mg/l
MWFW-01	Sulfate	556	mg/l
MWFW-01	Total Dissolved Solids	222	mg/l
MWFW-02	Chromium	42	ug/l
MWFW-02	Sodium	21500	ug/l
MWFW-03	Thallium	1.2	ug/l

Table 6
PHASE 1A ROUND 1 PIA ANALYTICAL RESULTS
THAT EXCEED PRELIMINARY 95% UTLs

Sample Location ID	Analyte	Value	Units
MWFW-04	Chloride	1.55	mg/l
MWFW-05	Chloride	1.25	mg/l
MWND-01	Cobalt	6.5	ug/l
MWNE-03	Aluminum	4390	ug/l
MWNE-03	Chromium	23.2	ug/l
MWNE-03	Copper	8.5	ug/l
MWNE-03	Iron	3960	ug/l
MWNE-03	Nickel	26	ug/l
MWNE-03	Vanadium	5.7	ug/l
MWNE-03	Phosphate-P	2.14	mg/l
MWNE-03	Phosphorus	2.85	mg/l
MWNE-03	Total Dissolved Solids	406	mg/l
MWNE-03	Total Suspended Solids	190	mg/l
MWNE-04	Cobalt	10.3	ug/l
MWNE-05	Magnesium	19100	ug/l
MWNE-05	Sulfate	360	mg/l
MWNE-05	Total Dissolved Solids	307	mg/l
MWNE-06	Calcium	64700	ug/l
MWNE-06	Alkalinity, Total	219	mg/l
MWNE-06	Chloride	1.12	mg/l
MWNE-06	Hardness	258	mg/l
MWNE-07	Calcium	130000	ug/l
MWNE-07	Magnesium	23600	ug/l
MWNE-07	Alkalinity, Total	247	mg/l
MWNE-07	Chloride	1.23	mg/l
MWNE-07	Hardness	435	mg/l
MWNW-07	Cobalt	7.8	ug/l
MWSW-01	Barium	122	ug/l
MWSW-01	Calcium	79100	ug/l
MWSW-01	Magnesium	17700	ug/l
MWSW-01	Sodium	22200	ug/l
MWSW-01	Chloride	3.65	mg/l
MWSW-01	Hardness	270	mg/l
MWSW-01	Sulfate	160	mg/l
MWSW-01	Total Dissolved Solids	420	mg/l
MWSW-02	Barium	81.9	ug/l
MWSW-02	Sodium	28700	ug/l
MWSW-02	Alkalinity, Total	162	mg/l
MWSW-02	Chloride	1.38	mg/l
MWWD-01	Sodium	52600	ug/l
MWWD-01	Alkalinity, Total	110	mg/l
MWWD-01	Chloride	1.12	mg/l
Surface Water			
BC01SW	Calcium	654000	ug/l
BC01SW	Magnesium	79600	ug/l
BC01SW	Sodium	34100	ug/l
BC01SW	Chloride	3.02	mg/l
BC01SW	Hardness	1946	mg/l

Table 6
PHASE 1A ROUND 1 PIA ANALYTICAL RESULTS
THAT EXCEED PRELIMINARY 95% UTLs

Sample Location ID	Analyte	Value	Units
BC01SW	Nitrate	0.665	mg/l
BC01SW	Sulfate	1940	mg/l
BC01SW	Total Dissolved Solids	3040	mg/l
BC04SW	Chloride	3.04	mg/l
BC04SW	Hardness	1934	mg/l
BC04SW	Nitrate	0.817	mg/l
BC04SW	Sulfate	1950	mg/l
BC04SW	Total Dissolved Solids	2960	mg/l
BC04SW	Calcium	654000	ug/l
BC04SW	Magnesium	79800	ug/l
BC04SW	Sodium	34000	ug/l
BC05SW	Calcium	643000	ug/l
BC05SW	Magnesium	80200	ug/l
BC05SW	Nickel	3.3	ug/l
BC05SW	Sodium	34200	ug/l
BC05SW	Chloride	3.11	mg/l
BC05SW	Hardness	1942	mg/l
BC05SW	Nitrate	0.866	mg/l
BC05SW	Sulfate	1970	mg/l
BC05SW	Total Dissolved Solids	2880	mg/l
BC09SW	Calcium	667000	ug/l
BC09SW	Chromium	7.4	ug/l
BC09SW	Magnesium	87000	ug/l
BC09SW	Nickel	4	ug/l
BC09SW	Potassium	4910	ug/l
BC09SW	Sodium	35300	ug/l
BC09SW	Chloride	3.34	mg/l
BC09SW	Hardness	2067	mg/l
BC09SW	Nitrate	1.13	mg/l
BC09SW	Sulfate	1990	mg/l
BC09SW	Total Dissolved Solids	3090	mg/l
TR06SW	Sodium	9300	ug/l
TR06SW	Total Dissolved Solids	277	mg/l
SW-12	Beryllium	3.2	ug/l
SW-12	Cadmium	44.1	ug/l
SW-12	Calcium	345000	ug/l
SW-12	Chromium	9.4	ug/l
SW-12	Cobalt	52.6	ug/l
SW-12	Magnesium	267000	ug/l
SW-12	Manganese	68600	ug/l
SW-12	Nickel	1190	ug/l
SW-12	Potassium	5290	ug/l
SW-12	Sodium	39900	ug/l
SW-12	Zinc	1160	ug/l
SW-12	Chloride	2.92	mg/l
SW-12	Hardness	1965	mg/l
SW-12	Nitrate	4.15	mg/l
SW-12	Sulfate	2100	mg/l

Table 6
PHASE 1A ROUND 1 PIA ANALYTICAL RESULTS
THAT EXCEED PRELIMINARY 95% UTLs

Sample Location ID	Analyte	Value	Units
SW-12	Total Dissolved Solids	3130	mg/l
SW-06	Cadmium	0.24	ug/l
SW-06	Calcium	824000	ug/l
SW-06	Chromium	1.1	ug/l
SW-06	Magnesium	101000	ug/l
SW-06	Nickel	10.4	ug/l
SW-06	Potassium	5670	ug/l
SW-06	Sodium	39900	ug/l
SW-06	Chloride	3.42	mg/l
SW-06	Hardness	2443	mg/l
SW-06	Nitrate	1.23	mg/l
SW-06	Sulfate	2360	mg/l
SW-06	Total Dissolved Solids	3580	mg/l
SWED-02	Calcium	820000	ug/l
SWED-02	Magnesium	102000	ug/l
SWED-02	Nickel	7.1	ug/l
SWED-02	Potassium	5610	ug/l
SWED-02	Sodium	40300	ug/l
SWED-02	Chloride	3.52	mg/l
SWED-02	Hardness	2533	mg/l
SWED-02	Nitrate	1.39	mg/l
SWED-02	Sulfate	2430	mg/l
SWED-02	Total Dissolved Solids	3780	mg/l
SWED-01	Cadmium	0.63	ug/l
SWED-01	Calcium	846000	ug/l
SWED-01	Magnesium	105000	ug/l
SWED-01	Nickel	3.6	ug/l
SWED-01	Potassium	5680	ug/l
SWED-01	Sodium	40900	ug/l
SWED-01	Chloride	3.63	mg/l
SWED-01	Hardness	2529	mg/l
SWED-01	Nitrate	1.44	mg/l
SWED-01	Sulfate	2430	mg/l
SWED-01	Total Dissolved Solids	3820	mg/l
ED-4	Antimony	3.2	ug/l
ED-4	Cadmium	0.3	ug/l
ED-4	Calcium	867000	ug/l
ED-4	Magnesium	105000	ug/l
ED-4	Potassium	5690	ug/l
ED-4	Sodium	41600	ug/l
ED-4	Chloride	3.73	mg/l
ED-4	Hardness	2623	mg/l
ED-4	Nitrate	1.52	mg/l
ED-4	Sulfate	2530	mg/l
ED-4	Total Dissolved Solids	3860	mg/l
ED-2	Antimony	4.1	ug/l
ED-2	Cadmium	0.55	ug/l
ED-2	Calcium	823000	ug/l

Table 6
PHASE 1A ROUND 1 PIA ANALYTICAL RESULTS
THAT EXCEED PRELIMINARY 95% UTLs

Sample Location ID	Analyte	Value	Units
ED-2	Chromium	1.9	ug/l
ED-2	Magnesium	93100	ug/l
ED-2	Nickel	3.5	ug/l
ED-2	Potassium	12200	ug/l
ED-2	Silver	1.8	ug/l
ED-2	Sodium	39500	ug/l
ED-2	Chloride	3.66	mg/l
ED-2	Hardness	2494	mg/l
ED-2	Nitrate	1.57	mg/l
ED-2	Sulfate	2540	mg/l
ED-2	Total Dissolved Solids	3650	mg/l
SW-02	Calcium	837000	ug/l
SW-02	Magnesium	89800	ug/l
SW-02	Potassium	4930	ug/l
SW-02	Sodium	40000	ug/l
SW-02	Chloride	3.64	mg/l
SW-02	Hardness	2433	mg/l
SW-02	Nitrate	1.58	mg/l
SW-02	Sulfate	2380	mg/l
SW-02	Total Dissolved Solids	4140	mg/l
OF01SW	Calcium	839000	ug/l
OF01SW	Chromium	0.89	ug/l
OF01SW	Magnesium	100000	ug/l
OF01SW	Nickel	3.4	ug/l
OF01SW	Sodium	40000	ug/l
OF01SW	Chloride	3.74	mg/l
OF01SW	Hardness	2506	mg/l
OF01SW	Nitrate	1.83	mg/l
OF01SW	Sulfate	2520	mg/l
OF01SW	Total Dissolved Solids	3800	mg/l
WDAC	Beryllium	4.3	ug/l
WDAC	Cadmium	3.7	ug/l
WDAC	Calcium	442000	ug/l
WDAC	Chromium	1.7	ug/l
WDAC	Copper	2.4	ug/l
WDAC	Magnesium	266000	ug/l
WDAC	Manganese	11700	ug/l
WDAC	Nickel	336	ug/l
WDAC	Potassium	7050	ug/l
WDAC	Silver	1.5	ug/l
WDAC	Sodium	35200	ug/l
WDAC	Zinc	352	ug/l
WDAC	Hardness	2202	mg/l
WDAC	Sulfate	2250	mg/l
WDAC	Total Dissolved Solids	3330	mg/l
Sediments			
BC01SD	Sulfate	755	mg/kg
BC04SD	Sulfate	563	mg/kg

Table 6
PHASE 1A ROUND 1 PIA ANALYTICAL RESULTS
THAT EXCEED PRELIMINARY 95% UTLs

Sample Location ID	Analyte	Value	Units
BC05SD	Sulfate	501	mg/kg
BC09SD	Nickel	41.7	mg/kg
BC09SD	Manganese	3690	mg/kg
BC09SD	Cadmium	1.1	mg/kg
BC09SD	Sulfate	710	mg/kg
SDBC-01	Magnesium	5510	mg/kg
SDBC-02	Magnesium	6040	mg/kg
TR05SD	Magnesium	4870	mg/kg
SDCD-01	Aluminum	26500	mg/kg
SDCD-01	Beryllium	10.7	mg/kg
SDCD-01	Cadmium	5.3	mg/kg
SDCD-01	Calcium	7830	mg/kg
SDCD-01	Chromium	19.1	mg/kg
SDCD-01	Cobalt	144	mg/kg
SDCD-01	Copper	103	mg/kg
SDCD-01	Iron	29800	mg/kg
SDCD-01	Lead	30	mg/kg
SDCD-01	Magnesium	5750	mg/kg
SDCD-01	Manganese	4650	mg/kg
SDCD-01	Nickel	230	mg/kg
SDCD-01	Sodium	191	mg/kg
SDCD-01	Thallium	0.48	mg/kg
SDCD-01	Vanadium	35.4	mg/kg
SDCD-01	Zinc	611	mg/kg
SDCD-01	Sulfate	2400	mg/kg
SDCD-02	Cobalt	12.3	mg/kg
SDCD-02	Nickel	23.7	mg/kg
SDCD-02	Manganese	1620	mg/kg
SDCD-02	Cadmium	1.4	mg/kg
SDCD-02	Sulfate	438	mg/kg
SDCD-03	Cadmium	1.6	mg/kg
SDCD-03	Copper	91.2	mg/kg
SDCD-03	Cobalt	24.9	mg/kg
SDCD-03	Nickel	39	mg/kg
SDCD-03	Manganese	2470	mg/kg
SDCD-03	Lead	20.9	mg/kg
SDCD-03	Zinc	94.8	mg/kg
SDCD-03	Sodium	183	mg/kg
SDCD-03	Sulfate	205	mg/kg
SDED-05	Cobalt	33.6	mg/kg
SDED-05	Copper	44	mg/kg
SDED-05	Zinc	117	mg/kg
SDED-05	Nickel	40.1	mg/kg
SDED-05	Manganese	1220	mg/kg
SDED-05	Magnesium	5870	mg/kg
SDED-05	Lead	22.1	mg/kg
SDED-05	Chromium	20	mg/kg
SDED-05	Sulfate	250	mg/kg

Table 6
PHASE 1A ROUND 1 PIA ANALYTICAL RESULTS
THAT EXCEED PRELIMINARY 95% UTLs

Sample Location ID	Analyte	Value	Units
ED01-SD	Barium	257	mg/kg
ED01-SD	Zinc	553	mg/kg
ED01-SD	Sodium	241	mg/kg
ED01-SD	Silver	0.43	mg/kg
ED01-SD	Selenium	7.2	mg/kg
ED01-SD	Nickel	516	mg/kg
ED01-SD	Manganese	33600	mg/kg
ED01-SD	Magnesium	4150	mg/kg
ED01-SD	Cobalt	31.9	mg/kg
ED01-SD	Chromium	23.1	mg/kg
ED01-SD	Calcium	12500	mg/kg
ED01-SD	Cadmium	14.4	mg/kg
ED01-SD	Beryllium	3.5	mg/kg
ED01-SD	Nitrogen, Ammonia	13.2	mg/kg
ED01-SD	Sulfate	1620	mg/kg
SDED-04	Zinc	301	mg/kg
SDED-04	Cobalt	20.9	mg/kg
SDED-04	Calcium	8140	mg/kg
SDED-04	Cadmium	9.7	mg/kg
SDED-04	Sodium	204	mg/kg
SDED-04	Selenium	3.9	mg/kg
SDED-04	Nickel	289	mg/kg
SDED-04	Manganese	21200	mg/kg
SDED-04	Sulfate	1330	mg/kg
SDED-03	Sodium	196	mg/kg
SDED-03	Nitrogen, Ammonia	9.73	mg/kg
SDED-03	Nitrite	0.8	mg/kg
SDED-03	Sulfate	1250	mg/kg
SDED-02	Cobalt	14	mg/kg
SDED-02	Sodium	172	mg/kg
SDED-02	Nickel	21.6	mg/kg
SDED-02	Manganese	1450	mg/kg
SDED-02	Nitrite	0.5	mg/kg
SDED-02	Sulfate	940	mg/kg
ED04-SD	Calcium	7090	mg/kg
ED04-SD	Cobalt	23.3	mg/kg
ED04-SD	Sodium	224	mg/kg
ED04-SD	Nickel	30.7	mg/kg
ED04-SD	Manganese	2490	mg/kg
ED04-SD	Magnesium	4380	mg/kg
ED04-SD	Zinc	86.2	mg/kg
ED04-SD	Chromium	20.7	mg/kg
ED04-SD	Cadmium	0.84	mg/kg
ED04-SD	Sulfate	1650	mg/kg
SDED-6	Sodium	204	mg/kg
SDED-6	Nickel	32	mg/kg
SDED-6	Manganese	2140	mg/kg
SDED-6	Magnesium	4030	mg/kg

Table 6
PHASE 1A ROUND 1 PIA ANALYTICAL RESULTS
THAT EXCEED PRELIMINARY 95% UTLs

Sample Location ID	Analyte	Value	Units
SDED-6	Cobalt	20.9	mg/kg
SDED-6	Chromium	22.6	mg/kg
SDED-6	Calcium	7590	mg/kg
SDED-6	Sulfate	1650	mg/kg
SDED-01	Chromium	19.5	mg/kg
SDED-01	Manganese	1960	mg/kg
SDED-01	Zinc	82.9	mg/kg
SDED-01	Sodium	268	mg/kg
SDED-01	Nickel	26.7	mg/kg
SDED-01	Cobalt	20	mg/kg
SDED-01	Calcium	7950	mg/kg
SDED-01	Sulfate	1780	mg/kg
SDED-07	Sodium	206	mg/kg
SDED-07	Chromium	18.1	mg/kg
SDED-07	Sulfate	1310	mg/kg
SDND-01	Iron	28100	mg/kg
SDND-01	Copper	30.1	mg/kg
SDND-01	Cobalt	14.9	mg/kg
SDND-01	Chromium	20.8	mg/kg
SDND-01	Nitrogen, Ammonia	10.1	mg/kg
SDNE-01	Magnesium	4490	mg/kg
SDNE-01	Iron	34100	mg/kg
SDNE-01	Cobalt	18.6	mg/kg
SDNE-01	Chromium	32.7	mg/kg
SDNE-01	Vanadium	44.8	mg/kg
SDNE-01	Thallium	0.71	mg/kg
SDNE-01	Potassium	5250	mg/kg
SDNE-01	Nickel	36.4	mg/kg
SDNE-02	Magnesium	4470	mg/kg
SDNE-02	Lead	23.8	mg/kg
SDNE-02	Iron	23200	mg/kg
SDNE-02	Cobalt	15.2	mg/kg
SDNE-02	Chromium	22.2	mg/kg
SDNE-02	Vanadium	36.4	mg/kg
SDNE-02	Nickel	19.3	mg/kg
SDSW-01	Phosphate-P	17.1	mg/kg
SDWD-01	Cobalt	21.3	mg/kg
SDWD-01	Sulfate	770	mg/kg
SDWD-03	Cadmium	1.2	mg/kg
SDWD-03	Selenium	1.9	mg/kg
SDWD-03	Nickel	39	mg/kg
SDWD-03	Manganese	12900	mg/kg
SDWD-03	Cobalt	33.5	mg/kg
SDWD-03	Sulfate	972	mg/kg
SDWD-03	Phosphorus	1428	mg/kg

Appendix A

Boring Logs And Well Construction Diagrams For Wells And Piezometers Installed In The PIA

Appendix A
Boring Logs And Well Construction Diagrams For Wells And Piezometers Installed In The PIA

Appendix B

Boring Logs And Well Construction Diagrams For Wells Installed In The Background Area

Appendix B
Boring Logs And Well Construction Diagrams For Wells Installed In The Background Area